DESIGNING FOR THE POST-MILLENNIALS:

WHAT ASSUMPTIONS ARE MADE BY STAFF IN MUSEUMS ABOUT CHILD DIGITAL LITERACY WHEN DESIGNING DIGITAL INTERACTIVES?

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What assumptions are made by staff in museums about child digital literacy when designing digital interactives?

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This research seeks to examine issues surrounding digital literacy discourse and its place within the museum. Using the design of digital interactives as an example, it asks what assumptions museums have made about child digital literacy, and how these assumptions have changed over the last fifteen years. The study proposes a new application of digital literacy theory that can usefully differentiate between what it categorises as realistic and optimistic perceptions of child digital literacy, and then uses this theory to understand how museums view their child visitors and how they design for them digitally.

The research adopts a historical approach in its methodology to look at the design processes and digital interactives over the last fifteen years, in three museums of digital interactive design. The thesis explores what it characterises as the 'four-step' design process (from user-centred design theory) to help it uncover where assumptions are made and what effect this has had on the resulting interactives.

The intention has been to make a case that when designing in-gallery digital interactives for children, the museums tend to adhere more to an optimistic discourse of digital literacy than one that might be seen as realistic, and that furthermore, this is a tendency that has persisted over the course of many years of design in three English museums. The significance of the thesis rests in the appropriation of digital literacy theory to form a greater understanding of museums' perception of their young visitors, by uncovering the influences on staff in their digital interactive design considerations.

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Chapter 1: Introduction

In 2009, the British Museum, in partnership with Samsung, opened a new centre as part of the museum. The Samsung Digital Discovery Centre was created 'to provide a state-of-the-art technological hub for children and young people to learn about and interact with the Museum's collection' (British Museum, 2014). It was designed for both visiting school groups and families, and for children from three to eighteen years of age, engaging with the collections through state-of-the-art Samsung technology in the form of workshops (*ibid*). The main purpose of the Centre was to positively influence children's learning about the collections mediated by the use of technology. In 2013, the Centre underwent a renovation, which resulted in a new range of the latest technology available; particularly touch screen tablets and digital cameras (Woff, 2013).

At the same time that the Centre was under development to enhance children's learning through technological use, Eschet-Alkalai and research partner Chajut published an article in response to their own 2002 research study on digital literacy. The authors found, during their study of digital literacy in high school age students in 2002 and again in 2007, that the students' information literacy had decreased significantly in the participants, despite an increase in other forms of digital literacy (Eschet-Alkalai and Chajut, 2009). Information literacy is one of four aspects of digital literacy that Eschet-Alkalai ascribes, but in the case of the Samsung Digital Discovery Centre's learning goals, it is the most important. Information literacy is 'the ability to consume information critically and sort out false and biased information' (*ibid*: 713). In contrast, the more basic forms of digital literacy, that of photo-visual literacy and branching literacy[1], had increased only marginally, in the case of photo-visual, and only slightly more substantially, in the case of branching (*ibid*: 714).

Whereas Samsung Digital Discovery Centre continued to assume that children wanted access to technology in a cultural setting and could make use of complex forms of it, the academy, in contrast, was evidencing a profile of child digital literacy in which children lacked certain understandings of digital literacy and that these had not

[1] From Eschet-Alkalai (2004), discussed in Chapter 3.

increased over time. It is around these differences (in the assumptions around designing digital media for children) that this research is located.

1.0 Research Questions

This study asks, within the UK context, and with in-gallery digital interactives as its example: What assumptions have museums made about child digital literacy? And have these assumptions changed since the millennium?

Children are now a primary focus of the study and research regarding access to computers, to the Internet and to mobile phones. In the developing world nations, mobile phones are becoming generally available and well used (ITU, 2012). In the developed world, like the United Kingdom (UK), computers, mobiles, the Internet and a wide range of other devices are owned in their numbers by the population at large (Ofcom, 2014). Several studies over the last twenty years have shown an increase in technology ownership and use by family groups in the UK (Ofcom, 2006; Ofcom, 2012). Also, technology take up has become prominent in even younger children than a decade ago (Ofcom, 2013). If the public are as connected as reports suggest what does this mean for institutions like museums that are in a constant struggle to appear applicable to their visitors? Museums succeed through the number of visitors they attract through their doors, no more so given the current economic climate of post-2008.[2] In order to continue to serve their public, museum institutions need to understand the public's needs and wants, including their use of technology. In the late 1990s, many museums began to include digital technology in their galleries and there are many instances of what worked and what did not (Anderson, 1999; Gammon, 1999; Tallon and Walker, 2008). However, little academic research has been published on this and many museums are still struggling to understand how much technology, if any, their visitors want to see. In light of this, an understanding of the suppositions museum staff and designers have made about the public, specifically children, in their past and present technology-enabled gallery designs is needed. Such an understanding will allow for a reflection on how digital exhibits have been designed and how the designs have changed as technology has changed and visitors' use of technology has evolved in

[2] Post-2008 meaning the climate within the developed world that has been directly impacted by the 2008 recession, thereby reducing cultural funding and leading to a negative impact on funding in the museum sector.

recent years. Within this is a very specific issue that is addressed in this study, which combines the changes in how children access and use technology, their potential media or digital literacy, and museum institutions.

1.1 Research Aims and Objectives

This study asks the question of what assumptions museum staff have made regarding child digital literacy and whether there has been a change in these assumptions over fifteen years, since access to technology has become widespread within the UK. It bases the understanding of digital literacy from a variety of literature. This research also seeks to explore these assumptions within the context of digital design and how they have affected the practice of using digital features in museum exhibits. The aim of this research is to show what changes there have been in three English museum institutions and what staff at those institutions have learned in their designing of digital interactives over the last ten to fifteen years. This research study will also allow for the opportunity to bring digital and media literacy theory and study into the field of museology and engage in a discussion about its use and influence in museums.

This study will evidence how museum exhibition design has changed in a three UK museums and how that design is affected by the inclusion of digital elements in the gallery space. This research will also present an understanding of how digital interactives are seen as an aspect of design by museum staff and the role digital interactives have played over the last fifteen years since they have become prevalent in many museums. This research intends to demonstrate how digital interactives have been designed and for what purpose they were included in the galleries. From this, the study aims to show what museum understanding of visitor usage of digital interactives has been and how this understanding has shaped more recent digital interactive design. The foundation behind this is a focus on child visitors and what assumptions museum staff have made about this younger audience.

This thesis presents a case in answer to these aims that staff assumptions in museums have been predominately focused on more optimistic discourse of child digital literacy, rather than realistic discourse. It also makes the case that there has been a high degree of continuity in these discourses of digital literacy since the beginning of the 21st

century. This lack of change has resulted in similarities in the design of digital interactives over ten years of practice, despite changes in technological availability in the case study museums. Though the aims of this study set out to uncover assumptions and their changes over time, the result of the research suggests that changes in digital literacy assumptions are not prevalent in museums in their digital designs for children.

1.2 Cultural Context

This study exists within the context of the UK. It is the culture of the UK that dictates much of what is presented in this study, from the level of government funding to museum institutions, down to the daily cultural choices of the UK public as to how they visit museums. The reports and studies of demographical data presented here are from the UK, where possible, and clearly indicated when taken from other countries (such as the US). Much of the academic discourse on the history of museums presented is also from the UK in an attempt to clearly show how this research sits within the UK museum field. Some reference is made to the United States, whose museum industry has, in the past, influenced aspects of the UK, but this is clearly stated. This study therefore presents a recent historical perspective on UK museums and a study of current practice in a selection of representative institutions.

In a world that is increasingly conditioned towards digital technologies (Castells and Cardoso, 2005) museums are struggling to implement the technologies that much of the world is now taking for granted (Stein, 2012): tablets, smartphones, the Internet, touchscreen, instant communication, and many other digital aspects of daily life. In order to do this, museums need to understand not just their public, but their publics' digital lives, their digital interests and digital abilities in order to make programmes and exhibitions the best they can be. To ensure that the use of digital mediums serves to allow the visitor to explore history, art, science and nature through a digitally mediated world. To do this, digital literacy becomes a fundamental understanding that all museums need to have and to use in their work. It is not simply a case of knowing what digital literacy is, but how it varies, how it can be applied to design, how the public understand it, how the media use it, and how it impacts the daily life of the visitor walking through the museum's door.

1.3 Terminology

Within the context of this study, several terms will be used with regularity. These terms form the basis of this research and relate directly to the research question: What assumptions have museums made about child digital literacy? And have these assumptions changed since the turn of the millennium?

First, the term 'museum' will be taken to mean a cultural institution that maintains a collection of objects to be showcased to the public and engages in the upkeep of galleries displaying those objects. These objects can be, but are not limited to, historical artefacts, artistic works, recent objects of current history, contextual information regarding collections, models, dioramas and digital records (audio, visual, and images).

Within this study, children are an important focus of the research. Children between the ages of five and fourteen constitute the first three Key Stages of education in the UK and are the focus of most museum educational programming and design (NMDC, 2013). Using only up to age fourteen for this research will mean that most children referred to in this thesis will have been born since the millennium, and since the wide spread adoption of technology in the UK by most families, the early introduction of 3G mobile networks and the use of the term Web 2.0, all of which are significant developments for this thesis (Ofcom, 2006; ITU, 2009; O'Reilly, 2005). The National Curriculum in the UK, which has in past directly affected museum programming and design was revised in 2000 (the last revision was in 1995).

The title of this thesis, 'Designing for the Post-millennials' follows on from this definition of children. 'Post-millennials' is currently a widely accepted term for the generation of children born on or after the turn of the millennium (Salkowitz, 2008; Bolinger, 2013). Though this term includes children who are currently below the age of five, chapters 6 and 7 will demonstrate that this young age range is rarely part of the focus of digital interactives. 'Post-millennials', unlike many of the generational epitaphs, was not coined by any one person, but rather links directly with the previous generation of children prior to 2000 who were termed 'millennials' (Howe and Strauss, 2009; Oblinger and Oblinger, 2005). In current discourse in academia and the media,

the terms ‘Generation Z’ or ‘Generation Alpha’ are also sometimes used for children born since the millennium, but it is not considered mainstream terminology.[3]

For this thesis, ‘digital literacy’ or ‘media literacy’ are often used interchangeably, however there are some differences that will be explained in greater depth in Chapter 3. ‘Media literacy’ is a term usually used to refer to the literacy skills needed to ‘read’ and understand information presented through media (television, the Internet, radio, images), while ‘digital literacy’ is a broader term that encompasses a more complex definition of the skills and understanding a person needs to operate competently in the digital world of today (Sefton-Green, Nixon and Erstad, 2009; Erstad and Amdam, 2013; Marty, et al., 2013). ‘Digital literacy’ is a term that is used most often to refer to children and their level of abilities with digital technology, but the debate surrounding the term is usually mired in the issue of what level of digital literacy is best for children to possess before completing formal schooling and entering the working world (Bawden, 2008). In this thesis, it is understood that ‘digital literacy’ (as well as ‘media literacy’) can come in a variety of levels of ability from technical skills through critical engagement. It is both the basic, technical skill level, and the higher levels of digital literacy that museums and this thesis are most concerned.

The term ‘design’ used in this thesis refers to the creation of a gallery or exhibit, or an aspect of a gallery or exhibit within a museum. The design specifically deals with the process of creating the gallery or exhibit by a team of people either employed at the museum or from an outside company brought in temporarily for the project. The design of museum galleries or exhibitions will be discussed about in greater detail in Chapter 4, which deals with the issue of User-Centred Design theory.

The term ‘in-gallery’ refers to the use of ‘museum’ in this research and is specifically concerned with the design of exhibits or aspects of exhibits that are placed within the gallery space or are a mobile programme that is meant to be used within the gallery space (as opposed to outside of it). Therefore, this thesis does not focus on museum

[3] USA Today (online) is, as of March 2014, running a contest to ‘name’ the next generation, giving 10 options. This is, however, based in the USA, from a previous contest in 2005 which identified ‘Homeland Generation’, from 9/11. The contest and accompanying article explaining the choices can be found here: http://usatoday30.usatoday.com/money/advertising/story/2012-05-03/naming-the-next-generation/54737518/1

websites or mobile applications (apps) that are meant to be used from the home of the visitor or outside the physical museum institution, as such designs have not allowed for staff to observe the visitor use and thereby develop an understanding of visitor engagement with this particular form of media. It is only recently that design practices in museums have become concerned with the design of programmes predominantly to be used outside of their space, and as this thesis looks back at the historical perspective of technology use in museums, as well as at recent perspectives, it is within galleries that all of the examples presented here can be found.

The use of the term 'digital interactive' is integral to this study. In this context, it is understood to be an aspect of an exhibit or gallery (or both) that is digitally based with software and/or hardware components and requires the visitor to interact with the interface. Digital interactives can be simple or complex and both will be discussed in this thesis, but interactivity between the visitor and the digital interactive or between multiple visitors and the digital interactive is essential. Though simple audio and visual displays in galleries will be referenced in this thesis, the main focus is on exhibits containing these types of media in conjunction with interactivity. For example, a television screen in a gallery will not be considered a digital interactive for this thesis, unless it contains an input capability for the visitor to tell the television to act in a certain way, such as making a list of choices available for the visitor to choose from. This limitation on interface-enabled interactives allows for visitors to be observed using the technology (rather than, for example, simply watching a television screen), allowing them to display digital literacy in their ability to successfully operate the interface.

Lastly, the use of the term 'assumption' must be examined within the context of this project. It is not the intention of this research to suggest that staff are showcasing negative reasoning in their design, however it is acknowledged that the word 'assumption' does usually have a negative implication. To assume means to believe or take something to be true without questioning it or having proof.[4] This definition suggests that the assumptions are false, however an assumption can be made without proof and still be accurate. The evidence presented in this thesis shows assumptions that staff have made, though they may not have evidence to support their reasoning or they

[4] Definition from the Cambridge Dictionaries Online (Cambridge University Press, 2015).

have not questioned their opinion. Rather, the assumptions are considered knowledge that they have gained by experience. This is sometimes suggested as tacit knowledge in academic theory, defined concisely as 'individual knowledge that is not typically articulated' and is 'useful for the person who uses it' in everyday life (Venkitachalam and Busch, 2012: 357). More broadly, if we look at tacit knowledge, it has a long history as a topic of discussion and one that has been subjected to disagreement on that concise definition (Gourlay, 2002). However, despite the disagreements surrounding its exact definition and suggestions of whether tacit knowledge is shareable or not, it can be understood to be something that is very individual, practical (versus theoretical), and informal (versus formal), as Wagner and Sternberg suggest (1986: 54). Nonaka believes that the difficulty with tacit knowledge being sharable is that tacit knowledge is, by its nature, difficult to formalise, making it difficult to communicate to others. It can consist of technical skills and mental models that individuals use in their work, but also beliefs and perspectives 'so ingrained that we take them for granted' (Nonaka, 1991: 98).

Digital literacy opinions by staff at the case study museums could be understood as tacit knowledge: that which they use in their daily work, but that which is not communicated or even fully acknowledged in their own minds. Using this tacit knowledge in their designs, however, they are taking their understanding of digital literacy to make assumptions about how children use digital, and as this research suggests, are doing so without realising it. However, the main focus of this thesis is to discover staff opinions on digital literacy: that is to have staff articulate and share their knowledge (that is knowledge which is internal, but can also be shared externally), which is somewhat in contradiction to the definition of tacit knowledge. The digital literacy opinions of staff appear in this study in both personal accounts, but also documentation shared amongst many people in different roles. In terms of this research, therefore, the word 'assumption' will be used, but it should be understood that it is not intended to convey any negativity regarding opinions by staff or institutional documentation. Rather, it is used in the context of staff assuming something to be true, though they have not conducted research into the matter.

1.4 Contextualising the Thesis

As well as the research and academic contexts outlined above, this study sits within the context of a number of other subjects. These comprise museum education, visitor studies, and digital heritage and the study of technology use in museums. Each of these discourses provides a way of studying museum institutions and their place in society, however each discourse approaches this study from a different perspective. In researching this thesis, all four of these discourses were taken into account and studied to understand where this thesis fits within and without them.

1.4.1 Museum Education

The main field of museology, which is the study of museums and their practices, has been prominent in academic discourse since the 1960s (Hooper-Greenhill 1999; Maroević, 1998). A large body of museum literature has focused on the educational quality of museums, which, in turn, pioneered the related field of visitor studies in order to understand museum audiences (Hooper-Greenhill and Moussouri, 2000). Museums have existed in the UK for several hundred years as public institutions (Lucas, 1908; Maroević, 1998). Historically, they were places where history could be presented to the public through the display of collections. Discourse on museum education surrounded a discussion about the role museums played in formal, school-based education, as well as the constructivist concept of 'learn by doing' which became popular in the 1980s (Hooper-Greenhill, 1999; Hein and Alexander, 1998; Hein, 1995b; Vygotsky, 1978). Vygotsky's work, though decades older, was only translated into English and readily available in 1978, which influenced the 1980s discourse on children's informal learning in museums, from which Hein approached his constructivist museum. This constructivist theory has been the basis of an increasing number of museum exhibition designs over the last several decades, allowing visitors a more open learning environment (Hein, 1995). Recently, this has come into sharper focus in academic literature and now museums are now practicing the idea of 'edutainment', where the audience is entertained and through entertainment they are educated (Williams, 2013; Lepouras and Vassilakis, 2004; Resnick, 2004). This appeals to the informal learning discourse that has surrounded museums and formed the basis of the debate on child visitors.

One aspect of museum practice is also the design of exhibitions. Connecting an understanding of child engagement with exhibitions is a key characteristic of this research. The focus for this study steers away from previous museological discourse on the visitor perspective of exhibitions and leans towards understanding the intentions behind the designs from the point of view of the museum staff. This study lies within the museum studies field, but with a different focus from previous discourse, where museum practice (the intended result) is the dominant discourse.

This thesis takes this established academic discussion about children in the museum and merges it with a discourse about technology use in museums to form the original basis for this study; that of digital literacy in museums.

1.4.2 Visitor studies

Visitor studies is concerned with both statistical information about visitors, including numbers and demographics[5], and more specifically with understanding visitor expectations and needs when visiting museums (Fakatseli, 2013; Screven, 1993). It forms an important part of the discourse about museum practice. It has become especially prevalent in recent years when the role of museums in communities have been questioned and museums have had to present themselves as a useful part of their community's cultural life (Watson, 2007). Understanding museum visitors is the basic research needed for a museum to provide the best service it can to people who come to view its collections.

Children form a specific aspect of visitor studies. Children are an important part of museum audiences and many museums spend their time and resources on appealing to child visitors (Hawkey, 2004; Culén, 2012; Bellamy and Oppenheim, 2009). General discourses on visitor studies are important for the museum sector, though on an individual level, research in institutions is more useful for the development of those particular institutions.

[5] Demographic type survey studies fall under 'audience studies', with visitor studies forming a wider field that encompasses qualitative data also.

Within this research, the visitor as the object of study is not the intended focus. Previous research within the museum has taken the approach of understanding the visitor in order to better design for them. In contrast, this research project seeks to take a step backwards from the established use of visitor studies to ask how museum staff understands their visitors and what assumptions and expectations exist within that understanding. This study acknowledges the importance of visitor studies in understanding visitor expectations and intentions, but suggests that museums bring their own expectations and intentions about their visitors into their designs, and it is these expectations and assumptions that impact digital interactives the most. As such, visitor studies is a grounding academic discourse from where this research begins.

1.4.3 Digital Heritage

The last field of study from which this thesis takes inspiration is that of digital heritage and the research of technology in museums. Digital media is now a main influence within the museum; it has become a catalyst of change by 'widening the horizon of possibilities' for cultural institutions (Parry, 2007: 139). In light of this adoption and appropriation of technology in museums, we have come to the field of digital heritage. According to Parry, digital heritage is a subject that encompasses the critical (theoretical) look at the relationship between museums and the technology they use (2007b: 334). It is a field that 'privilege(s) the present and future tenses' within its terminology, concerned mainly with a reflection of current and future practices and the outcomes of technological appropriation by museums (*ibid:* 344). However, Parry suggests that a more historical analysis of 'what cultural circumstances and discourses produced these elements' is a necessary area of research (*ibid*). Therefore, this thesis explores the historical analysis within the aspect of digital interactive design.

Digital heritage is a growing field that encompasses a diverse range of people from various backgrounds, making the field multi-disciplinary. As Parry notes, there is 'no typical digital heritage practitioner or scholar' (2010: 3). However, in 2008, the journal of *Museum Management and Curatorship* ran a special edition for Digital Heritage, to allow a range of academics and professionals who considered their research part of the diverse field to publish aspects of their work. The edition illustrates a wide variety of academic backgrounds and types of projects, showing how diverse the field is and how

varied the make-up of digital heritage researchers are. It is because of the diverse aspect of digital heritage that this research can be considered part of the subject; it examines a connection between museums and technology while making use of theory from two other fields; media studies and user-centred design.

Amongst a growing body of publications on digital heritage, there are currently several documents that demonstrate an important focus on the emerging technologies in the museum sector. However, they neglect to consider the theoretical underpinnings of the academic discipline. These publications are, however, a good place to begin to understand how technology is used in the museum. The Heritage Lottery Fund (HLF) review and the on-going New Media Consortium (NMC) Horizon Reports (2011, 2012, and 2013) publications are both measured from within the field of museums. The HLF review was specifically commissioned by the Heritage Lottery Fund, and the report was compiled by Flow and the Collections Trust, both central to the UK museum industry (McKenzie and Pool, 2010). In the case of the Horizon Reports, the authors are the N NMC, which had previously been concerned with new media and education, but has more recently begun to look at the impact of technology in museums as well. The DigiCULT Report in 2002, commissioned by the European Commission, focuses specifically on the use of technologies in the protection and preservation of museum collections for the public. Finally, the UK based research and innovation firm ARUP is responsible for the publication of *Museums in the Digital Age,* a 2013 exploration of technological trends in museums. TrendsWatch provide the American Association of Museums' (AAM) outlook on the future of technology in their institutions (Merritt and Katz, 2012). Unlike digital heritage, which is concerned with all types and uses of technology in the sector, these reports focus on technologies used by visitors to museums.

In 2010, the National Endowment for Science, Technology, and the Arts (NESTA) published their Culture of Innovation report, which, though focused on understanding innovation in the cultural sector. In addition, the report considered how technological change could be used by institutions to overcome obstacles in individual organisations (Bakhshi and Throsby, 2010: 4). An aspect of the report sets out what particular technologies were being used most often by museums in 2010; specifically the use of online museums (through websites) and the change from wall texts towards

'personalised presentations using mobile hand-held devices' (*ibid*: 22). The research illustrated that large, international museums were excelling at offering collections and accompanying data online. However, only a few museums around the world offered 360° views of their institutions and online engagement for in-house exhibits (*ibid*: 23-24).

The most recent report (prior to publication of this research), is the 2014 *Digital Culture* study, also by NESTA, which is a report on how English arts and cultural organisations are using digital technology as part of NESTA, Arts Council England and the Arts and Humanities Research Council's new Digital R&D Fund for the Arts. The report is from the second year of the funding project (the 2015 report to be released in autumn 2015). The report from 2013 demonstrated that museums (out of all the cultural organisations surveyed) were 'less likely than the rest of the sector to report positive impacts from digital technologies, particularly in terms of revenue generation and audience development' (NESTA, 2013: 5). The report from 2014 showed the same trend amongst museums (as compared to performing arts venues), with only 12% of respondents saying that they saw a major impact from digital technology in their organisation; 50% reported a 'fairly major impact' (NESTA, 2014: 10). The trade-off from this, the report suggests, is that organisations that have seen a higher impact from digital technology use are more likely to commit to future digital development (*ibid*). This report suggests that museums, more than other arts organisations, are struggling with their use of technology and how it can make a positive impact on their organisation and their engagement with the public.

These two reports show a more realistic view of how museums are appropriating technology this decade, and what impact that appropriation is actually having on their institutions.

However, these reports, like those in the field of digital heritage, are concerned with a forward facing view and often present an outlook of several years into the future. This is particularly so with TrendsWatch, which showcases current and developing uses of technology in US museums (*ibid*). The Horizon Report specifically uses a one to five year outlook, separating advances in museum technologies into the immediate and later future (NMC, 2011, 2012, 2013). These reports put forward ideas of what technologies

are likely to become more easily available to the cultural heritage sector and what technologies might be most useful for museums to acquire in order to engage visitors. This content is one part of a larger understanding of digital technologies for gallery use that must be understood by museums and exhibition designers. In this research, the forward facing view of technology adoption is contrasted with a view of the past. Rather than considering what technologies might be adopted in future, within the context of understanding museums' views of child digital literacy, this project seeks to go back to the early adoption of digital interactive design to understand what technologies have commonly been used and why (within the context of understanding museums' views of child digital literacy). This study demonstrates that understanding what has come before can give museums a deeper appreciation of how they have come to their current practices in digital design, and therefore improve their designs in future.

These reports showcase a view of museums and their use of technology, and how it has been used for positive change within the institutions. However, one area of research, which is missing from the above reports, is that of smaller museums within the UK. Typically, the participants in the studies have largely been the London-centric museums. This research deliberately engages with smaller museums, examining the reasons why certain technologies were chosen and what digital design options were decided upon when creating a gallery or exhibit. The 'latest technologies' are not always used or adopted and this thesis presents a look at how individual institutions have adopted bespoke technology to work both for their collections and their visitors.

1.5 Theoretical Context

This research project draws upon two key intellectual concepts and ideas - digital (or media) literacy and User-Centred Design (UCD). These two theories form the basis of the data collection and analysis of this thesis. Both of these concepts have a similar life span and were developed within the wider study of technology. There is a natural link between the two fields of study, which is that UCD is concerned with understanding the technology user and designing for them and digital literacy sets out to understand how the user uses technology and how well they understand it. Both of these fields have a discourse that has changed over several decades, where debate has centred on developing a common understanding by academics and professionals. These two

theories are sub-fields of larger fields of academic study as well, as UCD is one aspect of User Experience Design, whilst digital literacy is one of several types of 'media literacies' currently part of academic discourse (Saffer, 2010; Drotner and Erstad, 2014). Both of these fields will be discussed in greater depth in subsequent chapters. For this introduction, a brief overview of the fields as they stand is necessary to explain their inclusion in this thesis as the main concepts.

1.5.1 Digital Literacy

Digital literacy (DL) is a complex academic field of varying discourses and authors. It is sometimes combined with media literacy, but the two literacies are not necessarily the same (Erstad and Amdan, 2013). Media literacy (ML) refers to the ability to use various forms of media, and includes television and radio, not just modern computer technologies. Digital literacy is more concerned with computer-based literacy. Various authors define digital literacy in different ways (see Chapter 3). The most common definition of digital literacy comprises component parts. Fulfilling all these components makes a person 'digitally literate'. These components are the ability to use the technology, as well as an understanding of the technology and the ability to critique information gathered from the technology (Bawden, 2008). For example, a digitally literate person would be one who can perform a search of the Internet for relevant research data, find useful articles and be able to critique their reliability.

The history of digital literacy is less clear, and in the 1980s and early 1990s, prior to the launch of the Web, it was, as a concept, mainly concerned with skills (Martin, 2003). That is, the ability to operate a computer; to type, use a mouse and keyboard, and even simple abilities like knowing how to turn the computer on and off, actions that were considerably more complex than computers of today. It was the adoption of the Internet by a wide public that led to a discord amongst the digital literacy community in definitions of digital literacy. Some authors believe there are levels of digital literacy, beginning with basic skills and rising to full understanding and the ability to use the technology critically (Sefton-Green and Buckingham, 2004; Eschet-Alkali, 2004; Buckingham, 2009). Other authors, however, do not feel that skills-based literacy should be included in a definition of digital literacy (Gilster, 1997; Martin, 2003;

Ferrari, 2012). This discord in the academic community has made it difficult to form one single definition of digital literacy in which to work from.

The growing body of literature surrounding an understanding of children's digital literacy shows that, though there are multiple discourses on the subject, the importance of it academically and educationally has become even more apparent in recent years. Combined with a need to understand museum visitors to best equip an institution as useful to the community it serves, this research suggests there is a clear correlation between understanding how children approach and understand digital and how museums design with digital for them. While several authors that have written about digital literacy in culture, it is not a widely researched topic and there are few published case studies to understand the issue at the level of the average regional museum in the UK. Drotner's (2008) work, for instance, is Danish based, while Russo, Watkins and Groundwater-Smith in 2009 focused specifically on social media, rather than in gallery interactives.[6] Though Watkins' (2008) work on digital literacy in cultural institutions does begin to touch on topics presented in this thesis, the research is further concerned with social media acting as a method of exchange between museums and their communities. The subject of digital literacy is covered in depth in Chapter 3.

Whilst many people have heard the term 'digital literacy', few outside the academic community would be able to provide a full definition of it. Rather, they would offer their own individual understanding of digital literacy. This research project is concerned with understanding individual staff's views of child visitors and their digital literacy, and, this in turn, can assist us in understanding why there are such differing views. The main cause for discourse between the academic community and museum staff is likely attributable to the fact that optimistic discourse on digital literacy is very different from realistic discourse (Erstad and Amdan, 2013).[7] It is optimistic discourses, which museum staff have perhaps heard of, that are prevalent in articles and popular media. Digital literacy commonly appears in government discussions about Information Communications Technology (ICT) and informal education. Much of the debate over

[6] Specifically these examples cited here are from Denmark and Australia. Many case studies relating to digital literacy and culture exist with a focus on educational institutions or libraries, in and outside the UK, but not within museums.

[7] Optimistic discourse sees children as innately able to use a wide variety of technology, while realistic discourse cautions against such claims and suggests that children must be carefully taught digital literacy.

the last few decades has been about ensuring that children are 'digitally literate', which means they possess skills-based digital literacy first and foremost (Bawden, 2008). As such, the optimistic media view of digital literacy is less focused on critical engagement with information presented through a device. The common refrain from parents of the current post-millennial generation is that they feel their children are digitally literate, because they are able to use computer technology, not because they are able to critique information found on the Internet (Roxby, 2013; Moore, n.d.).

1.5.2 User-Centred Design

User-centred design (UCD) is part of a larger field of User Experience Design (Abras, Maloney-Krichmar and Preece, 2004; Saffer, 2010). Several other sub-fields encompass this, such as architectural design and interactive design. As this study deals with the design of digital interactives, Interaction Design (ID) will also be discussed in some detail in Chapter 4 and an explanation of its relationship with UCD presented, within this research context.

UCD, however, is the more prevalent, as it is the design of technology for a specific user or users (Abras, Maloney-Krichmar and Preece, 2004). All museums engage in UCD to some extent when creating exhibitions and programmes for their visitors. The research presented here suggests that museums institutions do adhere to some UCD principles and processes. UCD is generally concerned with designing for specific users where their needs are understood and incorporated. UCD in museums can often be a field that is not as well understood as it might be by designers themselves. However, the three case study museums presented here do engage in a form of UCD. Each has developed their own design method based on their staffing and design needs. The results of using UCD to discuss the case study work are presented in Chapters 5-7 of this paper.

Including UCD in this thesis in order to understand how museums design is an important step in this research. In the past, the concept of UCD has been used by such authors such as Gammon in 1999, who has served in a position of researcher from within and outside the Science Museum, to make publically accessible to museums data explaining the positives and negatives of using digital interactives. Articles from

Petrelli, De Angeli, and Convertino in 1999, and Petrelli and Not in 2005 provide excellent case studies of how research has demonstrated how UCD can be used in best practice in designing museum interactives. However, the majority of articles focusing on UCD and museums have been concerned with website design (see above).

UCD is used within this thesis to provide a context for understanding the case study data collected. Though digital literacy discourse formed the basis for the documentation and interviews conducted at the case study museums, UCD allows this research to be understood in the process of design. Understanding UCD processes and procedures and the theory of the field, allows for an exploration of the research data as a lens in which the case study data can be viewed through. For example, a way of viewing the data would be through understanding what UCD process each institution uses and how they differ from one another.

1.6 Methodology

A qualitative approach to data collection was employed in this research. The value of the data was paramount over the amount of data collected. The ethical protocols adopted by this project were approved prior to the commencement of fieldwork. Ethical permission included the right to speak with parents and children in the museum environment and the right to speak with museum staff and independent designers. Consent forms from participants in this study were collected and a copy of the forms is included in the Appendix A. During an initial pilot study at New Walk Museum (discussed below), care was taken to collect all data anonymously and to seek parental permission from the start of each interview. Interviews were conducted with parents and children together, in the museum gallery and under the view of the museum staff. Interviews with museum staff were all secured with participation given unconditionally. Interviews with staff were audio recorded for later transcription, and all data has been carefully protected digitally.[8] Staff accepted their words could be included in the final published thesis and that if they wished to withdraw they might do so until a given date.

[8] Audio interviews were copied to a password secured computer and their originals deleted. This was done after each day of interviews. Transcripts of the interviews were subsequently stored on the same computer.

The pilot study at New Walk Museum, in Leicester, served as an opportunity to both solidify the research focus, as well as to pilot various methods of data collection previously unfamiliar to the researcher. Trial interviews were conducted with two members of staff, who were involved in the redevelopment of the digitally enhanced dinosaur gallery. This enabled the researcher to understand what questions would be best put to such designers that would elicit answers useful for this research. Initial questions were close-ended and it was discovered that answers from the designers were very short and simple, and did not allow for them to explore their own thoughts on the designs and on children. In response to this, more open-ended questions were suggested that garnered more detailed responses and therefore rich data. This early study allowed for questions to be redeveloped for the main case study museums, which better served the research and also ensured the data was collected in an appropriate manner for such an academic study. The use of interviews and surveys with visitors was an original aspect of the research project, from 2011, and used during the pilot study to understand what its place would be in conjunction with the interviews with staff and with document analysis. Gallery observation was also undertaken as a pilot to explore whether useful data could be collected from unobtrusively observing children making use of digital interactives amongst themselves and in conjunction with their parents. Following observation, families were approached to provide visitor surveys (see Appendix B) about their museum visit. Questions centred on attempting to understand how digitally literate children were in the home and to compare that with to how they made use of the digital interactives in the galleries. It was proven during the visitor surveys and gallery observation in the dinosaur gallery (which focused on understanding how children used digital in the galleries) that digital interactives were popular amongst visiting children and that visitors – for the most part – expected their inclusion in museum galleries.[9] This knowledge allowed for the project to continue forward with the assumption that in-gallery interactives would be an appropriate type of digital technology to focus on in the research, as such technology was common in galleries, and widely used by visitors. However, the data collected also suggested that such interview and visitor studies methods did not accurately reflect children's digital literacy, just their perceived literacy, and that observation was most useful in showing engagement, not literacy ability. It is this reason that such hands-on observation and

[9] See Appendix B for the survey and questions that resulted in this evidence.

interviewing of visitors did not play a part in the main case study data collection. The pilot was conducted in the autumn of 2012, allowing for several months of time to contact and begin work at the case study museums, as well as to rework interview questions.

This research has been conduced through a case study approach. The object of this method was to enable similar research to be undertaken at several institutions, and then compared and contrast the data so that the research questions could be answered. Multiple case studies allowed for a wider view of the research question and its answers. Three institutions in central England were chosen to serve as case studies. A list of other institutions was originally produced, but after consideration it was felt that three case studies would be more appropriate for a research study of this size, while ensuring enough dedication could be given to uncovering and understanding the assumptions in each location, across a wide timeframe. The three institutions represent a wide range of similar museums across the UK. The three museums chosen fit certain requirements. The institutions had been museums since at least 2000. They had undergone large-scale renovations of their sites (or were created) in the last fifteen years. The three institutions all contained galleries and exhibits that employed digital interactives in a variety of ways. All three were considered 'family' museums, appealing to a large community of child visitors, but were not as large as many national museums and therefore easier in which to undertake research. It was hoped that there would be a range of staff to interview regarding the design of digital interactives, although this was not a contributing factor for choosing the museums (a large number of staff from the National Space Centre were available compared with the few staff involved in digital design at Weston Park Museum). Finally, all three institutions had recently or were in the process of creating a new exhibit or programme involving digital interactives at the time of this research project.[10]

The three institutions that formed the main body of this research were the National Space Centre in Leicester (NSC), The Herbert Art Gallery and Museum in Coventry, and Weston Park Museum (WPM) in Sheffield. Each institution, its history, and digital design will be detailed in Chapter 5.

[10] See Appendix C for a list of projects examined in this thesis.

Research undertaken at each of the three institutions comprised of interviews with staff, observation of visitors within the galleries, a critique of several in-gallery digital interactives most widely used by visitors, photographs of previous exhibits and documentation from the museum archives (consisting of design briefs, prototypes, written notes, and evaluations). At the National Space Centre, an on-going project to redevelop a static gallery into a digitally interactive form was available for observation. This observation included attending design meetings throughout the process to hear staffs' perspectives about children who would use the gallery and how they designed the interactives for them[11]; project updates from the project leads, particularly to do with on-going prototyping; and a tour of the gallery prior to launch to demonstrate the interactives and identify last minute difficulties the project team uncovered once the gallery was in place. The project meetings were attended and observed over the course of the winter of 2013, and encompassed four main project meetings where the entire design team gathered to discuss the project.[12]

At Weston Park Museum, four staff were available for interview. When the museum was first approached to be a case study for this research, there was the hope of more members of staff being available for interview. However, recent (prior to the commencement of this project) staff reshuffling meant that few staff were available who had had involvement in the redevelopment of the museum. Thus the four staff members who were interviewed were Alan Silvester, newly created Digital Producer; Alistair McLean, the Curator of the Natural History gallery who was responsible for the creation of some of its digital interactives; Laura Travis, the Learning Manager who is in charge of all aspects of education within the gallery spaces for children; and Rowena Hamilton, the Exhibition and Display Curator, who had a high level of involvement in overseeing the gallery redevelopments and was particularly useful in discussing the lead up to that redevelopment. Gallery observation and interactive critiques were conducted

[11] All of the interactives included in this thesis were designed for either children (specifically), or families (meaning children accompanied by an adult) to use. The design intentions behind these interactives are focused on children and how they will use them with, however, the understanding that older visitors might also make use of the interactive. Several interactives discussed in Chapters 5, 6 and 7 were targeted at a wide audience in order to cater to this, but with a focus on child engagement specifically (references from design documentation and staff comments).

[12] These meetings are labeled by numbers 1 through 4 in this thesis, and the staff member who made the comment included in this research is referenced by name. Ex. Mowbray, Project Meeting # 2.

in the *What on Earth!* gallery and *Sheffield Life and Times*, as these were more digital and most oriented to a wide range of child ages.

From the Herbert Art Gallery and Museum, interviews were conducted with Martin Roberts, Senior Curator and Huw Jones, Keeper of Collections, both of whom were in charge of the Herbert's redevelopment and served as project leaders (both have been with the museum for more than a decade); Alison Taylor, who has long been the Senior Learning Officer, but who is now also the Inclusion Officer for the museum; and Graham Moore, who was newly put in charge of Children and Young People as Coordinator of projects and programmes involving those under eighteen years of age; Mel Corner, the Family Learning Officer who brought a particular educational background to her work and was very focused on how children use museum spaces; and lastly Richard Elms, the Head of Herbert Media, who developed much of the digital content for the museum in recent years. In terms of gallery observation at the Herbert, *Elements, Discover Godiva*, and the *History Gallery* were observed because of their heavy use of digital. A critique was also carried out of the interactive designed for the *Secret Egypt* travelling exhibition, developed by Herbert Media.

At the National Space Centre, the project team involved in the new gallery development (as research was ongoing) were interviewed. These included Kevin Yates, the Exhibition Development Manager who served as project lead; Paul Mowbray, the Head of NSC Creative, the NSC's design company and also a designer himself; Graham Law, the Head Technician, who handles many of the digital interactive issues in the centre; Gareth Howell, originally the Web Designer for NSC, but also now serving as Interactive Designer and the main creator of digital for the new gallery; Darren Clegg, a Graphic Designer who is in charge of graphics for NSC Creative and the NSC; and Charlotte Isham, the Education Officer, who was also part of the team and served as the learning officer for the development of the gallery. Also interviewed was Neil Shorrock, the General Manager of the centre who, having served for many years in various areas, was able to comment on the development of the NSC over the course of its lifetime. Kevin Yates also served in this role, having been brought in soon after the centre opened, though in various other roles before taking on the responsibility of exhibition development. The 'WeatherPod' station, *Space Now* gallery and the under-development 'Sun, Earth and Moon' exhibit were observed. A critique of the *Space*

Now interactive table and the interactives added to the new 'Sun, Earth and Moon' exhibit formed an important addition to the design briefs and staff commentary on visitor use and understanding of the systems.

From this comprehensive range of data collection it was evident how museum exhibits were designed, how digital interactives were chosen and designed, and what had changed (if anything) in the design process of the institution. Moreover, to understand which staff were involved in the exhibition design, how child visitors interacted with digital exhibits in the galleries, what understanding of their child visitors did museum staff have in the past and at present, and what lessons had been learned and used in recent projects based on past successes and failures. It is the richness of the research data that facilitates this detailed view, with interviews, documentation, observation and critique allowing for comparison and contrast across the case studies.

To complement this data from the museums, three independent designers working in the field of website, interactive and mobile design were interviewed (Mike Ellis, Martin Bazley, and Joe Cutting). These designers were approached because museum staff knew their work and their names were suggested during interviews. Further research into their backgrounds suggested they would be suitable candidates to comment on changes in digital design in museums and in digital literacy design. The designers were asked similar questions to those of the museum staff, to enquire if there were differences in assumptions made between the museums and design companies. Though these designer interviews did not form a large part of the data collection, they did, nevertheless, serve as a way of reflecting on the evidence gathered from the three case studies. It was found that the independent designers had, typically, a more measured view of children's digital literacy abilities. In their dealings with a wide variety of institutions, the designers communicated that they were also aware of the more optimistic assumptions in digital literacy in interactive design in museums.

1.6.1 Interviews

The methodology chosen for this study employs a triangulated approach to data collection where various types of data can be collected in order to test against one another critically. Yin suggests various types of methods, including interviews,

documentation and observation, all of which are employed in this research project (2003: 83 & 86). The methods employed to collect data for this project were in accordance with best practice suggested by Glesne and Peshkin (1992: 64, 78-87). These two authors specifically advocate a useful list of approaches to interviewing that specify an attention to detail, to the interviewee and to open-ended questions. Interviews were semi-structured, after the pilot study suggested this would garner the most detailed answers, to ensure that there was shape to the answers sought in accordance with the research, but to also allow interviewees the chance to express their opinions and to feel more at ease to answer in a way that suited their own work, as Gillham suggests in his guide to interviewing (2000: 5-6). Gillham defines semi-structured interviews as those that ask the same questions to all participants, that contain questions developed with a specific focus, use questions to prompt the interviewee to stay on track, and generally ensure that interviews with all participants are roughly the same length to create a pool of research data that can be analysed at a later date (Gillham, 2005: 70). In order to understand the opinions and assumptions of museum staff in their design of digital interactives for visitors, questions were asked of staff that worked in a variety of roles and came from varied backgrounds to better show differences and similarities of opinions within institutions.[13] All of the staff were involved in at least one project that employed digital interactives as part of the exhibition. The questions posed consisted of one-on-one interviews, but in one case two staff were interviewed together about a project they had both worked on. Questions were qualitative in nature and approached in a semi-structured way, i.e. several questions were prepared before the interviews took place and then redirected depending on how staff answered preliminary questions and their position at the museum. This was undertaken to ensure that the questions, where possible, were tailored to each staff member's position and work and so questions on topics that did not concern them (for example, a gallery they had no involvement in) were left out; this according to suggestions laid out by Glesne and Peshkin (1992: 66). This enabled staff to feel more at ease to discuss subjects they were familiar with and could answer honestly.

[13] Within this thesis, interviews with staff are designated by the use of the 'pers. comm.' short form after a name. This differentiates interviewees at the museums from other resources used in this thesis (ex. Yin, 2003).

Within the three case study museums, details of the project and the use of the data were explained to them before the interview began, ensuring the staff understood the focus of the research was on understanding how they viewed children and their digital literacy. However, the term 'digital literacy' was not openly used, as it was felt that perhaps staff would not immediately understand the term. Instead, a general explanation of digital literacy was given to staff to ensure that they understood the nature of the research as fully as possible before questions were put to them. Additional contact with staff members involved in the study was achieved through email to gain further documentation where needed and photographic records of exhibits. This was undertaken on an individual basis with staff who offered their assistance with gathering this information, with the permission of their institution. Further documentation data was also gathered from Haley Sharpe Design, who holds the documents for the National Space Centre. This data was collected with the full written consent of the company and with the National Space Centre itself. Interviews with three independent designers were also conducted and consent was agreed from each prior to the interview.

Questions asked of staff were, where possible, focused on understanding digital design at each institution, past and present and what role children had played in those designs. Questions also approached whether staff had developed any understanding of previous assumptions made when designing digital interactives and the sort of 'hindsight' questions about what staff would change, if at all possible, in their galleries. These questions were approached by asking a broader comment to each staff member on the digital design of the museum, and then narrowing this down to digital designs that child visitors would use. Based on staff reactions, specific interactives that they provided as examples were focused on to understand how the interactive was designed, what role children played in the mind of the staff member during the design, and how staff viewed children's digital abilities, both as a general concept and specific to the interactives that were discussed as examples. From these questions, it was hoped staff would be able to provide their view of child digital literacy abilities, and how interactives were designed for and used by children (based on their own observations). The questions provided answers from which assumptions and particular opinions about children and their literacy in the design of various interactives over a number of years would become clear, as this thesis demonstrates.

1.6.2 Documentation

Glesne and Peshkin (1992: 54) and Yin (2003: 87) advocate the use of documentation to corroborate and support other data collection (specifically interview data). Where possible, documentation was obtained from the three institutions that served as case studies. Documentation consisted of design briefs and plans for the galleries (past and present versions) that showed the basic description given between museum staff and the exhibition designers for each digital interactive element. Some further documentation (where it existed) on individual digital projects and programmes was also collected. The issue of lack of documentation data in museums which is not directly related to object registry was a challenging aspect of this research method, as there are clear gaps exist where the word of staff is the only information. However, while gaps do exist in the documentation, there are, nonetheless, eyewitness accounts, which help to fill in those gaps. Staff can provide a very useful addition to documentation; they can provide a personal account that can explain the reasons behind decisions taken. Documentation was collected as far as possible to ensure the least number of gaps and it is the projects where several types of data collection were used that are the predominate examples analysed for this research project.

Photo and image documentation was collected from all three institutions too, highlighting before and after photographs of gallery designs as well as, in some cases, the prototypes of the digital interactives in the galleries. This particular type of evidence was used to support other documentation, interviews and images, particularly in cases where other types of documentation were lacking or staff were not able to comment on a specific interactive in the same amount of depth as other examples.

1.6.3 Observational Study and Gallery Critique

Observation and critique in previously chosen galleries at each museum was also undertaken, based on child visitor observation at digital interactive stations and a critique of the whole gallery in relation to these digital aspects. The use of gallery critique in this research is informed by Serrell's work in the US, which used exhibition critiques in order to develop a framework for 'accessing exhibitions from a visitor-centered perspective' in order to improve exhibitions for the benefit of the public (2006:

3). It also follows on from Ben Gammon's (1999) work in the Science Museum in London, which set out to critique the use of interactives by visitors and to create an understanding amongst staff of how to improve the systems, the main part of the research consisting of gallery observation. The chosen galleries were those displaying examples of digital interactives. This critique was carried out based on the researcher's past experience, as no institutional critique of these specific museums and galleries was publically available, beyond individual critiques by museum staff. Where possible, staff who had undertaken their own critiques of the galleries were included in the staff interviews so that some comparison between their own observations and the researcher's could be explored in chapters 6 and 7.

The use of direct observation in this study is in accordance with suggestions made by Taylor-Powell and Steele, and, in particular, aligns with their views on understanding an 'ongoing behavior, process, unfolding situation or event' (1996: 1). Taylor-Powell and Steele also suggest there are various ways to conduct direct observation, including looking for certain data, looking at people or activities, or 'observing what does not happen' (*ibid*). All three types of direct observation were employed in the gallery observation and critiques conducted at the case study museums in order to generate a wide pool of data about the interactives in the galleries. The observation was unobtrusive in order to have as little impact on the visitor's behaviour as possible, so as not to influence their use of the digital interactives. Observation was conducted, where possible, in full view of the interactive in use, but out of the direct eye line of the visitor. Because of the general nature of the data recorded, field notes were employed as the main form of record, though Taylor-Powell and Steele suggest this type of recording is the least structured, though popular in anthropology (*ibid*: 3). However, such recording did allow for quick note taking of immediate observations.

This study is also similar to the research in 2014 conducted at the Natural History Museum and the V&A in London by Moussouri and Vomvyla.[14] Their project made use of gallery and visitor observations in order to measure how visitors engaged with digital systems in the gallery space (discussed in Lewis, 2014).

[14] Research by Theano Moussourri and Eleni Vomvyla, titled 'Cross-disciplinary frameworks for studying visitor experiences with digitally mediated museum exhibits' which has not yet been published, but was observed by Andrew Lewis in a presentation on 9 September 2014 at the Natural History Museum.

1.6.4 Project Study

Due to an on-going project[15] at the National Space Centre, a further method of data collection – how participant observation should be conducted - was undertaken there, in accordance with recommendations by Glesne and Peshkin (1992: 42-45). This research employed participant observation during the project study, as Schensul, Schensul and LeCompte suggest, in order to understand the organization of the museum, its staff and to generate questions to be asked in interviews (1999: 91). Specifically, this research was conducted with the knowledge that unbiased participant observation is particularly difficult, but that the importance of such research emerges from the observation over time (*ibid:* 95). As a consequence, detailed field notes were taken during participant observation of any subject or theme related to digital design and children, to be analysed at a later date in conjunction with interviews conducted with staff members.

This unique opportunity to observe an on-going design project allowed for the NSC to act as a case study that represented the most current assumptions being made about children's digital literacy in a design of a new gallery development. The unique nature of the opportunity involved significant research time at the institution to observe the project and speak with staff members involved. It is because of this intensive time commitment that similar research was not undertaken at the other case study museums. It was understood, however, that research taken from this particular project study could not make assumptions on behalf of the other museums' assumptions and designs. The National Space Centre welcomed an observational researcher onto the design project, namely a redesign of an existing gallery. Data from this method was collected through attendance at design meetings where the researcher did not participate but gathered written data about the design process as well as the specific design of the digital interactives to be included in the galleries and any mention of 'children' during such meetings. Interviews with staff on the project were also conducted to understand their reflections on the process and their observations within the meetings, with all design staff at the launch of the project and with specific staff at the end. These specific staff were the ones most heavily involved in the digital interactive design and the choices

[15] This project is the 'Sun, Earth and Moon' exhibition that is detailed in Chapters 5, 6 and 7 which launched in 2013.

made surrounding their inclusion in the gallery and therefore could comment in detail on the outcome of the project from their point of view.

It is the combination of interviews, documentation, observation and critique as well as project observation at the NSC that encompasses the research collected for this study. As the study focuses on staff decisions and assumptions, this type of qualitative data collection is most useful to understand an individual's thoughts, both past and present and note changes in each institution. It also allows for the data to become the central focus in answering the question: what assumptions have museums made about child digital literacy? And have these assumptions changed since the turn of the millennium? No prior bias as to a right or wrong answer was sought during the collection of this data, and the individual nature of the research collection meant that the answer of each staff member could speak for itself. As such, certain institutions show larger differences than others and have changed in their assumptions over the last fifteen years. This suggests that each museum is, evidently, different and this is an important distinction in understanding any aspect, design or otherwise, of museum practice.

1.7 Thesis Outline

This thesis is structured into eight chapters. Chapter 1, the introduction, presents the research questions and details the cultural and academic context of the thesis and the methods of data collection.

Chapter 2 of the thesis is the first of three further context chapters. It presents the technological provision for children in museums. This chapter allows a background within which the thesis can sit in the field of museology, specifically in the discussion of the role children have played in the more recent adoption of technology for visitor use. It highlights the importance of children as their own visitor population to the institution and the ways in which museums have endeavoured to provide for them in ways that are educational and entertaining, and more importantly, technological.

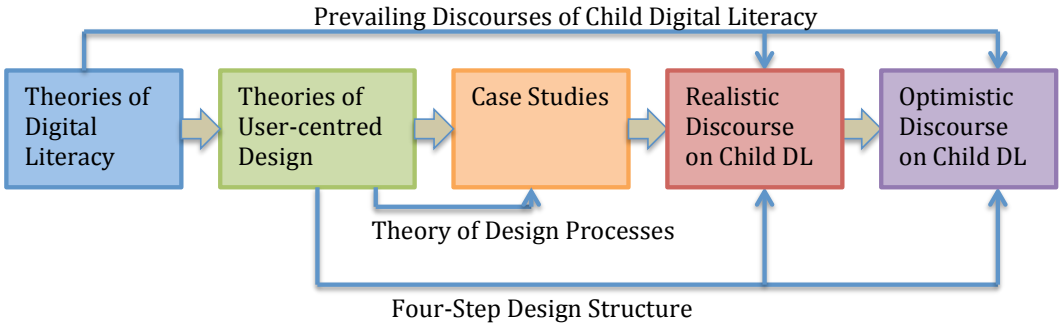

Figure 1.1: A Conceptual Map of the Thesis. Diagram by author.

Chapter 3 introduces and explains the concepts of digital and media literacy, which have formed the basis of this thesis and influenced the collection of the data presented in later chapters, as Figure 1.1 demonstrates. Chapter 3 is a pivotal chapter, which places this thesis within a new area of study, linking museology with digital literacy and media studies. It presents the dichotomy between optimistic and realistic discourses in digital literacy, explaining their varied backgrounds and current impacts, as well as charting the change in understanding of literacy on both sides of the debate over the last decade. This chapter suggests that museums are institutions in the public realm and, therefore, sites where popular discourses in digital literacy are most apparent and can most affect digital design.

Chapter 4 puts forward the theory of User-centred Design (UCD), which is used for the analysis of the research data, by examining design processes and how they are appropriated for use in the design of digital interactives in museums. In particular, the four-step design process is illustrated in this research, which is most apparent in and useful for museum interactive design. The design process consists of requirements, design, prototyping and evaluation phases. It is these phases or steps that have been used in the data analysis to separate digital literacy assumptions by staff into each part of design, to understand where assumptions have been made across the three institutions and allow for a comparison where most assumptions were made during the early stages of the design of a digital interactive.

Chapters 5, 6, and 7 present the data collected and results. Chapter 5 continues on from the ideas presented in Chapter 4, surrounding the four-step design process of

interactivity. It introduces the reader to the case study museums, by examining how they represent different types of digital production throughout the last fifteen years. Each institution has formed their own version of the four-step design process, and has also undertaken different types of digital interactive design within and outside the institutions. The four-step design process is explained in terms of its use in the data analysis phase and how it serves to structure the arguments around digital literacy in the proceeding chapters. Chapters 6 and 7 lead on from the discussion in the second half of Chapter 3, examining optimistic and realistic discourses in digital literacy, by demonstrating the assumptions made by the case study museums within these two disparate outlooks of children's use of digital. Both chapters employ a structure using the four-step design process, breaking down the assumptions into separate parts of the process, and employing the data collected from interviews, project observation at the NSC, documentation and gallery critiques in order to uncover the answers to the research questions.

Chapter 8 concludes the thesis by drawing the context chapters and research chapters together to argue for the significance and importance of this thesis. It outlines the limitations of this study and the future directions that it might take. The conclusion also presents several other findings from this study that fall outside of the main research question, but that had an indirect impact on the research or conclusions. The chapter concludes by detailing what contributions this thesis makes to the fields of media studies, museum studies and digital heritage and the use of qualitative methods of data collection. The conclusion of this thesis shows us how we might reconsider the ways in which we reflect upon the design process in the museum, by looking at and understanding the steps of that process. It also allows us to understand how changeable the needs of audience segments may, in fact, be. This research also helps us to examine the field of digital heritage, as well as providing a historical approach to a current and forward-looking field.

This thesis argues that within each institution, the discourses that support realistic forms of digital literacy are contrasted with optimistic opinions that suggest children have a natural affinity for technology. Within the design process of digital interactives at the three case study museums, both of these discourses are clear in each step of the process, and often at odds with each other in the designs. However, the opinion amongst

museum staff that children are drawn to digital technologies and have a particular ability to use and understand them is clear, despite changes in digital literacy understanding in the academy as well as in popular media in recent years. This thesis asserts that, according to the research conducted and analysed for this project, there appears to be little obvious change in the last fifteen years in the assumptions made by these three museums around children's digital literacy.

This research project suggests that museums are institutions in the public realm, and that their understanding of digital literacy aligns most with optimistic discourses; however individual members of staff can bring (and have brought) their own realistic and more measured understanding to their work which can balance the overly optimistic opinions of children and their technological abilities. The case study museums in this study have, over fifteen years, shown consistent and similar assumptions and expectations about visiting children and their media use within the institution, as the following research demonstrates.

Chapter 2: Technology in the Museum

2.0 Introduction

This chapter intends to encompass a review of literature which details the digital provision made for children in museums. It presents the previous research undertaken on topics that focus on technology in museums. It is not an exhaustive review of all literature, but it presents the authors most relevant to this study and the research that most closely showcases where this study lies within the wider museological context.

The purpose of this discussion is to provide the context of this thesis within the larger field of study and examine why this thesis is particularly important to the topic of children in museums and digital design. The incorporation of digital technologies into galleries for the use of visitors is now obvious, building upon early content management systems into the more recent technological revolution of mobile and web-based applications that can now be found. However, within this revolution is the assumption of the place technology (ICT[16]) holds within museum galleries and the sense of their necessity for a visiting public that consists of children. The latter sections of this chapter examine recent literature surrounding the issue of ICT inclusion in museum and its impact on visitors.

2.1 Technology and the Provision for Children

In many museums today, in many parts of the world, technology is just as evident as on the street outside. The museum information, which lists ticket prices and opening times, are now often displayed on television screens that can be continuously updated to show current events and exhibits. The information kiosk screen that has been prevalent in museums for many years is routinely the first point of visitor contact to give them an idea of the museum layout, exhibits and programmes offered. More and more museums today harness wireless technology, allowing the visitor full and free access to the Internet from their mobile device as they browse through museum collections. And

[16] Information Communications Technology, the overarching term for digital, though somewhat incorrectly still used today to refer to all technology, it specifically refers to Internet connected technology.

there are other museums, like the British Museum and many other well-known institutions across Europe and North America, that offer mobile apps that can be downloaded ahead of time and allow the visitor a fuller experience when viewing collections and looking up information. That museums will incorporate technology into their exhibits and their design processes seems to be something the public takes for granted. It can likely be assumed that the public therefore expect technology to continue to be available in many aspects of their lives. Museums make this assumption as well and, eager to attract visitors from all backgrounds, have sought to entice them through their doors with the promise of digital design and an enjoyable technology experience to engage with the in-house collection. Technology does lend a certain sense of the future (or at the very least, the present) to institutions that are caretakers of the past. Technology can promote engagement and interaction with collections, such as at the V&A in London (according to their UK Strategy: Frampton and Davies, 2011: 5), or assist with the enjoyment and engagement of modern art, as Tate's digital strategy suggests (Stack, 2013). Museums have come a long way from thirty years ago when the only computer technology found were early database and cataloguing systems (Parry and Sawyer, 2005: 39). Now, even small museums implement the use of this software, to protect their records for future generations.[17]

2.1.1 Digital Design in Museums

Though ICT use originally began in museum institutions as part of document management and curatorial work, the last two decades have seen a remarkable change in use towards integrated technology in gallery spaces and in delivering cultural collections to the visitor (Parry and Sawyer, 2005: 46). ICT use has provided museums' the opportunity to become 'the enabling, immersive, multi-sensory, information-rich experience that we know it to be today' (*ibid*: 42). The academic field of study encompassing technology integration in museums is digital heritage (Parry, 2007). Digital heritage is a subject dealing with a critical look at the wide use of technology in the museum, from collections management systems to the use of 3D imaging of archaeological objects and recording of digital information for the future (Parry,

[17] Such companies as Vernon Systems (http://www.vernonsystems.com) and Adlib Museum Lite (http://www.adlibsoft.com/products/adlib-museum-lite) specifically cater to the smallest institutions.

2007b). It is the study of technology in the museum that precedes and therefore informs current uses of digital.

Today, with the use of ICT it is a very rare occurrence for a visitor to 'encounter a completely passive experience when visiting'; that is to visit a museum without encountering any form of interactivity, be it digital or physical (Marty, 2008: 131). For museums, this is seen as a positive move, as educational research over the last decades, specifically by Falk and Dierking, shows that visitors who can participate more in their learning take more away from the experience, such as through social communication, object handling and access to computer kiosk information (Marty, 2008: 131). However, the best way to accomplish this is to ensure that the ICT itself does not dominate the experience, but rather that the system is transparent and supportive of the museum's collection (Mintz, 1998: 29). It must also be remembered that the so-called 'hands-on' physical, as well as digital, interactives do not automatically mean 'minds-on', that the visitor is actually engaged and learning (Caulton, 1998: 2). However, it can be postulated that people who enjoy a visit are more likely to learn something from it, and there is the expectation in museums that making exhibits interactive does lead to visitor enjoyment (*ibid*: 17).

The basis of interactive design comes from the idea that people who are doing something are likely to learn from it more than from just reading a text panel. This is originally Piaget's theory of learning about children: that they learn through doing (*ibid*: 18). Though Piaget has become less referenced in more recent learning theory,, his theories still characterise much of exhibition design for children. Learn by doing also allows for different types of learning in a museum, rather than just the static learning of cognitive information (*ibid*: 20).

When museums design their galleries using ICT, Semper (1998) advises that there are four main principles that must be understood to ensure the success of the exhibit for the visitor. The gallery designers must understand that visitors require a social experience and that technology must assist in this; visitors wish to find their own path based on their own interest and not to necessarily follow a chosen route; that this is the basis for how visitors learn, by the ability to follow their interests and make their own choices; and, lastly that the place they are in, the actual museum, is just as important to their

experience as the objects themselves and that ICT should not detract from the overall experience of visiting a museum (Semper, 1998: 120-121). Through these principles, museums have been able to develop various types of ICT design techniques for gallery spaces to allow the maximum flexibility for the visitor. There are the centralised installations that are usually found in an area separate from the main gallery and were once primarily for information kiosks (Sayre, 1998: 137). These allow interested visitors to enter them and search for further information, and for non-interested visitors to bypass them without feeling as if they have missed a section of the exhibit.

Following on, the next type of design technique is the use of decentralised installations that are found in the gallery space and become part of the exhibit (*ibid*: 138). These are still often the most expensive to design and install and they are more difficult to change once placed, but they do allow the visitor to engage between the collection and the technology in the same space. Again, these are still often information type kiosks. Embedded installations, which are a form of decentralised installations, are completely integrated within the exhibit and enhance the visitor experience with the object (*ibid*: 139). These are the interactives becoming more popular in galleries today as museums move away from information kiosks on site, to information provided online or on a mobile. They are designed to work within the gallery space by becoming transparent technology; ICT that support the visitor's experience without being noticeable. These types of interactives must have clear goals to be useful and understood by visitors, such as being easy to use by a variety of people, something that encourages social communication between visiting groups, something that is enjoyable and also easy to maintain (Caulton, 1998: 28). These types of interactives can allow the visitor to explore and experience for himself or herself and the learning becomes more personalised and experiential rather than knowledge-based (*ibid*: 37).

2.1.2 Current Technology in Museums

ICT that museums use can no longer be divided into three general categories: mobile, online and in gallery. Mobile, for example, can be used in gallery, and online is now accessible on a mobile device. Instead, a better categorization of ICT in museums would be by where the activity takes place (in-gallery, at home, in the classroom, on the street); the platform it uses (web, app, programme); and device (mobile, tablet, PC). We

have stepped further into the field of digital since the late 1990s, when the drive for museum interactives first began. Mobile and online or web technology are ICT aspects that the visitor can encounter outside of the museum building, from the comfort of their own home and before and after an onsite visit. With the ease of access to Internet and mobile technology in the UK, more visitors are able to engage with such technologies (Ofcom, 2014). Because of these developments in ICT use in museums, and how prevalent they are becoming, professionals and academics are deeply invested in the research and understanding of their use and usefulness. Scholars have identified a number of issues that surround the use of ICT in the museum environment, which shows that designing with technology is not a ready solution to visitor engagement or visitor attraction, but rather an idea that each museum must carefully consider and implement (Caulton, 1998: 36; Gammon, 2008; Walker, 2008). ICT allows the visitor contact with a great deal more information, through kiosks and apps, than traditional text panels allow. They also allow museums to design for a wider audience and adapt, using the technology, to the interests and learning styles of many visitors. ICT use around objects can also give the visitor a more nuanced understanding of the history and knowledge surrounding the object through computer modelling and reconstruction (Humm, et al, 2010: 347-8).

One of the main academic concerns with the integration of ICT in the museum specifically involves how the public will use that technology. The abundance of information available through hand-held devices such as audio guides and apps can, for example, create 'bottlenecks' throughout exhibits because the visitor spends more time at one exhibit and therefore impedes the flow of traffic behind them (Stock, et al, 2007: 269). As well, many visitors to museums are in groups, either as families, adults or school tours. It is of interest amongst academics and museum professionals whether the use of ICT might deter smaller groups from social interaction, since members would be concentrated on their own digital devices and their own path through the exhibition.

The largest academic concern surrounding technology use in museums has stemmed from the concept that ICT distract the visitor from the main purpose of the museum, which is to display objects (Klingender, 2010: 313). A study in 1998 based in a wide variety of subject specific US museums discovered that galleries that were object-based in their display, rather than technology or working model-based, actually held visitor

attention longer. However, the study discovered there was a narrow line between a successful object exhibit and an over-crowded one, which ceased to hold visitor attention. Exhibits that contained many dioramas (working models) actually caused visitors to move through the exhibition more quickly and spend less time at each station (Serrell, 1998: 39 & 42). Falk and Dierking have also observed this phenomenon in their research. They also discovered that too much information delivery was detrimental to the visitor; they simply could not process it and therefore lost interest (Falk and Dierking, 2000: 119-121). A similar study by Economou (1998) found that digital technology can have a positive impact on attracting the visitor to a display and encouraging them to stay longer in a gallery to enjoy the interactives, however follow-up research with visitors months after their visit found that the interactives did not increase their engagement with the objects or with their continued learning post-visit. The study did find that children, rather than adults, were more likely to use the interactives, though the younger the child the less time they spent with the technology. Though the difficulties presented for ICT use in museums are many, in each instance there seems to be enough positive exposure to outweigh the negative.

An article published online in April 2012 on the website The Atlantic made the following point:

> Today museums must compete with a host of entertainment options that didn't exist a generation ago. Customers who could be down the street seeing *Titanic: An IMAX 3D Experience* instead are unlikely to be satisfied with the old school, cattle-like shuffle past painting after painting, just as patrons with smartphones in their pockets don't want to read names and dates off of little white cards. (Stevens, 2012)

The assumption that the visiting public will be unimpressed by the traditional form of viewing a host of paintings on museum walls or objects behind glass is one that has permeated the museum profession and the academic discourse. This point was already a key issue even as early as 1998 (Caulton, 1998: 1). In order to compete, museums have turned to ICT use in their exhibits, their websites and the way they connect to the public, to offer potential visitors an experience that involves learning, but also entertainment.

In the last few years, the trend towards the technological explosion of multimedia forms in museums has increased exponentially; helped in part by the ease of access to ICT and also the advancement of technology to the point that it can be incorporated into nearly anything a museum design team can create. Technology has become 'less visible through [...] smaller devices' states a paper published several years ago on developing a national media strategy for British museums (Timpson, 2011: 301). The widest trend that has encompassed nearly every aspect of museums is the push towards the use of words like 'user-generated' and 'producers' that imply a move from a passive museum going audience to one that is involved and engaged with the museum, its programmes and the design of exhibits (Valtysson, et al, 2011: 107).

This trend in visitor engagement and involving the potential visitor in many aspects of the museum process has permeated to the point that the public can now help create the online museums of the future through engaging with online collections, museum objects and even developing an online platform where visitors become the sharers of knowledge (Jackson, 2010: 157). This can be seen in museum websites and online visitor engagement.[18] It is a push towards involving the visitor in their own learning, rather than delivering the content to those that may enter a museum out of interest in a particular subject.

2.1.3 Assumptions in Technology Use in the Museum

Linked to the museum sector is research on educational use of ICT. This is through the underlying assumption museums make that interactives will attract and interest children who routinely use them at home and in the school and therefore make the museum environment more familiar, while also making it more educational (Witcomb, 2003: 133). This assumption is primarily based on the predominant drive towards including ICT in all levels of education in the UK. If it is taken for granted that technology in schools is both useful and interesting for children, the museums attempting to attract more visitors, especially family groups, would be correct to use

[18] Examples of this are: the Tate, in London; Smithsonian National Air and Space Museum, in DC and Virginia; Brooklyn Museum; Museum of Anthropology, Vancouver; the Google Art Project; Smithsonian Cooper-Hewitt National Design Museum, New York; and the National Maritime Museum, London.

similar types of ICT in their design. In 2004 the Department for Education and Skills released a report on learning and teaching with ICT for primary schools as a push to introduce technology to younger children. The report begins with the claim that technology should be used in schools because 'it is an intrinsic part of our everyday lives, and children love to use it to play and learn' (Department for Education and Skills, 2004). It is reports such as this that drive museums to believe that 'children will be attracted to any computer exhibit' (Gammon, 2010: 284). This is an approach that must be cautioned, says Russo and Peacock, in that 'the enthusiastic embrace of participative media technologies by museums may lead to the initiatives which assume a 'build it and they will come' attitude (Russo and Peacock, 2009: 1). Rather, museums must focus on what exactly their users want, rather than what they assume will interest them.

Visitors to museums come in many varieties, not just in the numbers in which they enter a museum, but in their prior intentions towards the visit and their needs while there (Kennedy, 1994: 2). Inevitably, visitors will find ways to interact with museums that were never thought of by the designers, nor intended. Museum exhibitors need to understand that visitors will find their own paths through the galleries and make their own meanings (*ibid*: 3). Participation by visitors will be based on their needs and wants and not, in the first instance, what the museum tells them to do (Russo and Peacock, 2009: 6).

Another assumption that appears to hold true based on observational work in museums, is that younger visitors like to explore exhibits and learn through trying things out for themselves (Rossi-Linnemann, 2010: 30). In order to appeal equally to adults, suggests Rossi-Linnemann, the best way to design galleries is to design for children specifically, with exhibits that are understandable and evoke play and exploration, while containing enough information to appeal to adults (*ibid*: 30). Also, an interactive that is too complicated will be uninteresting for the visitor, no matter their age. Design must take into account the users' prior knowledge of how technology works, so that interactives can be explained in simple terms to visitors or, preferably, figured out by the visitor on their own initiative (Hughes, 2010: 155-56). Touch-screen controls should be obvious to the visitor and any buttons should be simplified so that children can use the interactive as well as adults (Gammon, 2010: 285-86). Interactives

that can be used equally well by all ages will attract multi-generational groups, like parent-child, to stay longer in the exhibit and interact more with each other, states McManus (2001: 88). Easy to understand and manipulate exhibits are also important, since children learn by doing rather than reading instructions and like to 'show' their parents how things work (*ibid*: 90).

2.2 Designing for Children

Several research studies have focused on digital technology in museums specifically for children. Some of these have focused on designing with children to ensure the best design for the finished product available to all visitors. This last section will give a review of what work has previously been completed on linking children, technology and design in the museum in order to best display where this research sits. This is by no means a new idea. Before the advent of digital technology in museums, academia was already reporting on similar ideas; the understanding that audiences are different and that adults and children should be designed for differently (Hooper-Greenhill, 1996). Jensen, in *The Educational Role of the Museum*, states that children need to be both educated and entertained, through engaging, attractive and accessible programmes and exhibits (1996: 115-6). In the same book, Dodd explains clearly that the point has to be to design for specific audiences and not the 'general public' (1996: 133).

The earliest advents of museum design with technology came first in the science centres in the UK and America. These designs focused on participation of the visitor and interactivity. Even a decade ago, however, such digital interactives were already considered ubiquitous (Scott, 2004: 127). Scott questions the world of digital technologies littered through museum galleries, stating that in the current market their presence is 'considered necessary' but that there are many questions that need to be asked before designing digital interactives. They need to be justifiable (*ibid:* 128). Adams, Luke and Moussouri echo this statement, explaining that 'there is a widely accepted assumption in the museum field that visitors, particularly children, want and must have computer interactives', but this assumption, the authors contend, is both unproven and out-dated (2004: 163). Back in 2004, it seemed clear that even then more research was needed to understand interactive design and visitor use –and the assumptions museums were making about both.

Around the same time as Adams, Luke and Moussouri were writing about the need for more research, more research was being conducted. A study at the Science Museum's *Energy Everywhere* gallery was undertaken, with just ten participant children, to understand how children engaged with interactive exhibits. This is an example of a typical study at this time: small and contained within a single museum. The children, aged 9-13, the age the gallery was aimed at, were interviewed in depth to understand whether the children felt they engaged with the interactives, learned anything from them and whether they felt the interactive allowed for collaboration with others. It quickly became apparent in the study that the children did not put much emphasis on collaboration as important, but rather the presence of others in the gallery and around the interactive was more significant as it gave them the sense that using the interactive was 'right' (Haywood and Cairns, 2006: 10). The aspect of the interactive that was most important was the chance to become fully immersed in it and allowed for a level of fantasy pretend that children enjoyed and could share with others (*ibid*: 13-14).

A similar focus in the last ten years has been on research into visiting school groups in museums, and the intention has been to study their learning in the galleries, through sociocultural learning in groups and educational levels of galleries, much as the study at the Science Museum has shown (Dahl and Stuedahl, 2012)**.** Studies such as this[19] are useful and important for museums that must justify the use of large amounts of money on their digital interactive designs, but visitor enjoyment cannot be forgotten over learning potential. Rather, as Gammon states, learning is more about active engagement; it is not just about the dissemination of knowledge, but developing social skills and even physical skills (2003: 3-4).

Recently, a new concept has emerged that shows this more broad definition of learning in museums. It links both the interactive design and the visitor use, while providing research on the outcomes of digital designs in museum galleries. This is the concept that centres children in the design process and even, occasionally, allows a child to participate. The idea comes centrally from Scandinavia, where user-centred design and

[19] Other studies as examples are: Griffin, 2004; Falk and Dierking, 2000; Anderson, 1999; and Lewin-Benham's work (1997). There is, however, a wide body of literature into exploring educational visits to museums (see Griffin's bibliography).

visitor participation is common. Culén, at the 2012 DREAM conference, presented a paper on Scandinavian children's museums where children have been involved in the design of the interactives as a continuous process, not just in one-off projects (Culén, 2012: 92). Involving children allows for certain outcomes, not least a workable design that has been prototyped and tested, but also allows the children participating to develop new skills through new experiences. Culén's work is centred at the Oslo Children's Museum, which is well aware that the children they cater to now have grown up in a digital world, that they '[learn] through play' using the technologies in the galleries to have experiences (Culén, 2012: 88). The Oslo Children's Museum may be unique in its approach, despite the fact that it is not yet a museum with a geographical location, but gives the opportunity to chart a design process in recent years that involves children at its core. However, this example shows how children can be involved in design, and how also a museum can use user-centred design principles to design a museum for a specific type of visitor. Children's museums have a history of user-centred design, but not on the level of designing with the user in collaboration (*ibid*: 90). Children of all ages were involved, using the younger children to help form designs and using older students to actually complete the design projects, in conjunction with designers (*ibid*: 91). Culén believes that having children involved in prototyping and evaluation in museum design can ensure both a good design outcome and increased learning for the children involved (*ibid*: 88).

The research reviewed in this chapter reminds us that visitors bring their own assumptions about technology into museums; what the availability will be, how it will be used, where they will engage with it (home, onsite), and the relationship between technology and child visitors. To the visitor, museums are places that contain objects of the past or the 'real stuff' and visitors come to museums to see these glimpses of the past, not foremost the technology of the present or future (Falk and Dierking, 2008: 19). New technologies must enhance the experience of a visitor who comes to view the objects (Falk and Dierking, 2008: 28). This research seeks to develop our understanding of how museums see technology and its use within the gallery to enhance the museum object and subject matter. As this study will demonstrate, museums bring their own assumptions about technology use and visitors to their designs, and can in some ways contrast with the visitor assumptions about technology in the gallery.

2.3 Understanding the Relationship Between Children and Technology

This chapter has attempted to provide an overview of previous research conducted on technology use in museums. It is by no means an exhaustive review, but it is a reasonable compilation of current and useful research for this thesis. The history of technology use itself in the museum is relatively short, compared to the history of museums in the UK, but a great deal of research has been undertaken in the most recent decades to show the take up of digital by museums. However, despite this wealth of literature, there is a noticeable commentary on the questioning of the place technology has in the institution and its use in visitor engagement, particularly for children. This commentary draws into this study's issue of assumptions about visitors made in the design of digital interactives. Though the research on technology in the museum is extensive, the focus on relating technology use in museums to child visitors is much less prevalent, though by no means absent. It is within this subsection of literature that this research sits.

The following two chapters now go on to form the theoretical framework of the research and of the findings presented in chapters 5, 6 and 7. Chapters 3 and 4 demonstrate two fields of study that are central to this project. To accomplish this Chapter 3 presents the theory of digital and media literacies, which form the basis of the data collection and theoretical underpinning for this project. It sets this study within the field of media studies and ties it to the field of museum studies, which is a topic of only recent interest in the academic sector. The authors' work presented in Chapter 3 builds upon the discussion in this chapter on how museums have provisioned for and understood their child visitors, but specifically within the context of digital literacy. Chapter 4 also informs the literature in this chapter on children and technology design in museums, but presents a more detailed account of user-centred design practices and their impact on how museums design digital interactives. The next chapter examines a theoretical application for the data analysis of this project's research, taking the practice of UCD from within the museum field in order to uncover and explain the placement and consequence of staff assumptions.

Chapter 3: Child Digital Literacy

3.0 Introduction

The previous chapter delved into the more recent use of technology to provision for children, and its somewhat controversial use in museums. Our discussion now turns to the second of our three contextualising concepts, that of 'digital literacy'. Significantly, whereas the last chapter (on museums, technology and children) provided an important academic and professional context for the subject as a whole, the discussion here lays out key elements of the theory underpinning the development and implementation of the collection of the project's research data. Simply put, the discussion in this chapter provides a framework for the research using the concepts of digital literary, specifically those of the varied optimistic and realistic viewpoints on children's media ability. There are complications with using digital literacy theory, which are explored below. These centre on the complex nature of the field and a noticeable dichotomy between these viewpoints and their practice.

This chapter gives an overview of digital and media literacy studies, while focusing on a more detailed analysis of digital literacy and its nuanced debates. It proposes an interpretation of digital literacy that is relevant to this research study. From there, this chapter explores the optimistic and realistic dichotomy of digital literacy practice and the concept of digital competence.

The theory used in this chapter and the following chapter present difficulties. Both of these fields are relatively new compared to the development of museums themselves, and both are the focus of academic debate. They are also fields that have not generally been applied in museological discourse. Drawing these two fields into museum studies is the central aim of this research and the primary context for the data collected. This requires the study to develop a unique understanding of these two topics as they pertain to museum practice.

David Buckingham, on describing adult views of digital literacy theory, states that '[t]hese assumptions may be unspoken, but they nevertheless infuse everything we do: they inform the questions we ask, the methods of investigation we adopt, and the

criteria we use to define what counts as valid knowledge' (2000: 104). The assumptions and understandings presented in this chapter have characterised views of museum staff for over a decade, in how they design digital interactives, as well as educational programmes, as Chapters 6 and 7 will demonstrate. In order to understand the impact these assumptions have had on designing for children, we must first understand from where these assumptions originate. Below is a historical discussion of the background of these new literacy assumptions made by adults, from their early development in the 20th century through to our current understandings.

3.1 Optimistic vs. Realistic

'Across the world there is a passionate love affair between children and computers' (Papert, 1996: 1). This emphasis on children and their relationship with technology has existed since radio was first introduced, followed by the television. According to Erstad in 2010, '[t]he concept of a digital generation has been dominating the public discourse on the role of digital media in young people's lives', varying between concerns of technology as a danger and as a solution (2010: 57). It could be contended that neither of these arguments is useful, as they are both too general; either technology causes harm or technology will fix what are perceived to be problems. It could be challenged that, instead, a better argument is an open discussion about how to teach a new generation to be digitally literate.

The debates discussed in this chapter can be seen, from the point of view of this research, to fall into the categories of 'optimist' and 'realist'. This research does not seek to suggest new terms or ways of looking at digital literacy within its own field, but rather to identify the varied debates around digital literacy and children that have historically taken place. For the purposes of this work, Selwyn's idea of uncovering a 'realistic' view of children and their literacy and Buckingham's suggestion that there are 'optimistic' ways of viewing digital literacy are used, as digital literacy lacks a widely accepted set of theoretical terms (Selwyn, 2009; Buckingham, 2007 and 2008). There is also what could be called a more pessimistic debate that ranges from claims that technology is negatively impacting children's minds at a fundamental level, to more moderate claims that the amount of screen time for children is affecting their mental abilities to be attentive and engaged. However, this latter claim is more realistic

in its origins, and as such will be discussed under that category. The optimists' argument stems from the opinions of authors, such as Tapscott (1999, 2009) and Prensky (2001), and suggests that children are able to intuitively use a range of technology to its fullest limits, becoming the so-called 'creators' that appropriate technology in new and innovative ways. It is this rhetoric about the 'digital native' that has shaped 'public, political and academic expectations of the technological capabilities and demands of those children and young people who were 'digitally born' in the late twentieth and early twenty-first centuries' (Selwyn, 2009: 365). The realist argument, in contrast, is characterised by its tendency to be far more measured; Oblinger and Oblinger (2005), for instance, fall more in this category, as does Buckingham (2000, 2003, 2008). It is here where academic research mainly sits, and a drive to understand children in as many ways as possible to better articulate the role technology plays in their lives. Recently, popular media has taken up the optimists' debate almost entirely, with only some realistic discourse to outweigh, but not better understand, the issues surrounding children today.

In light of this, this study has created and will make use of the terminology of optimistic, to refer to the debate ranging through the media and public discourse, that children can be inherently digitally literate. It will use the term realistic to refer to the approach that is more measured and couched, usually, in terms of academic research contexts, with a cautionary approach to digital literacy. Beyond these two poles fall also a wider range of opinions within the discourses on digital literacy, but as the majority of the research presented here, and indeed the data in Chapters 6 and 7, can be grouped under optimistic or realistic, these terms are used throughout.

3.2 Optimistic Discourses in Digital Literacy

To begin with, we will look at what can be seen as the optimistic discourses surrounding child digital literacy. Selwyn, who advocates against optimistic claims of children's innate digital literacy, views this as common-sense thinking, or as Ng defines it: 'common-sense thinking is uncritical, episodic, and disjointed, but it is also powerful because it is taken for granted' (1997: 44; Selwyn, 2009). This study argues that the optimistic viewpoint of digital literacy has become prevalent in museums (Chapters 6 & 7). This common-sense opinion comes from many sources: nation-wide reports, the

education sector and popular authors, such as Tapscott and Prensky (discussed below). In this view of digital literacy, there is an assumption that the generation of children called 'Post-Millennials' (and for many, even the previous generation who are now adults, called 'Millennials') are different in their understanding and use of technology than older generations. This difference is reflected in constant use of technology in their daily lives, and the expectation that this constant use therefore implies digital literacy. Government report stances (discussed below), over the last decade, on media and digital literacy in children usually reflect this concept also, believing that literacy is a simplistic ability to use technology in everyday life, such as to communicate via email and search the Internet. Though these simplistic attitudes to the uses of technological tools are part of the greater view of digital literacy, they are but a small part of being 'digitally literate' (Buckingham, 2006). Brabazon views such simplistic uses as the idea of 'clicking replaces thinking' or a cut and paste culture, where there is not critical engagement with information (2007: 16). These differing understandings between popular and the more rigorous and researched academic views on digital literacy, media literacy or digital competence continue to perpetuate a field that is still contentious.

It is reasonable to argue that government initiatives towards digital literacy for all citizens work from an assumption that, in the modern digital world in order to function fully in life and work, a person must develop at least a certain level of digital competency. In 2009, DCMS and DBIS published *Digital Britain*, a UK government report on ensuring that the UK became 'one of the world's leading digital knowledge economies' (7). The report detailed a list of what aspects could move Britain towards this, such as increasing the communications structure of the country, becoming a more creative capital and offering more quality in public service content (*ibid*: 47, 105 & 135). The ultimate goal of the report was to explain how each citizen of Britain must be able to go online confidently and feel safe using digital technologies in their everyday lives (*ibid*: 189). 'Digital literacy' is not directly mentioned, but the intention by the report to make all UK citizens part of a 'digital Britain' implies an understanding of digital literacy as the ability to appropriate technology for everyday life. This type of attitude toward digital literacy is what Erstad and Amdan (2013) call 'policy'. Policy consists of government initiatives on digital literacy skills, and reports such as Ofcom's regular update on the media use of children (Erstad and Amdan, 2013). For Ofcom in particular, a focus on media use is tied up with their understanding of media (or digital)

literacy, as can be seen in the title of their 2006 report *Media Literacy Audit*, which provides a list of what technologies are used by children and where children use them. Later reports by Ofcom have tended to simply refer to 'media use' rather than media literacy, but continue to report on the same type of use and location of that used by UK children (see Ofcom, 2013). The World Economic Forum in 2012 took the concept of media literacy one step forward, proposing an opportunity in the coming years to ensure that citizens in developing countries could become not just digitally literate, but what they termed 'digitally fluent': creators, not just consumers of digital technology (World Economics Forum, 2012). The report presents levels of digital literacy, starting at basic literacy (reading and writing), followed by access to technology where the basic literacy can be used, then 'technological literacy', which is the ability to operate the technology. From here, consumers can develop their critical thinking with technology issues and appropriation for a wide range of problems. Lastly, consumers can become 'software literate', meaning they can create their own software to solve issues in their daily lives. From here, consumers become creators and 'digitally fluent' (*ibid*: 3). This step process through digital literacy does show a more rounded view of the field than typical reports mentioned above, but still fails to truly understand the definition of digital literacy, where critical literacy skills are the central focus of being digitally literate. The focus remains on access and ability, with critical thinking and problem solving being relegated to a skill of consumers who are becoming 'developers', on their way to creators (*ibid*). It is difficult to believe that all citizens of the world must become creators of technology in order to be digitally literate in their everyday lives, though many citizens may indeed do this. This optimistic view of digital literacy found in government reports, though similar to the authors discussed below, does present an issue: where are the authors of such reports finding their information and why is the discourse so optimistic? This is perhaps a larger issue within how government and organisation reports are written, and where their evidence is taken from. In terms of digital literacy, however, it seems clear that the intention of the reports mentioned here is to drive development of technology and to make certain that segments of the population do not get left behind as digital becomes more and more a part of every day life.

Accompanying the ideas about digital literacy presented by government and organisational reports is the concept presented by populist authors (discussed below).

These are individuals, usually in a professional sector that deals with technology, who write on the topic of digital or media literacy, who present an optimistic view of how children are particularly good at using digital technologies and that they are different and more competent than previous generations, having grown up surrounded by computers. Such authors are, for this thesis, viewed differently than the other authors discussed, as they will generally publish their work for the use of the audience particular to their sector. They are also considered here as popular authors because of how their work has been disseminated into public discourse (such as government and organisational reports) on children's media use and ability. It has often been this optimistic discourse that has been adopted by the public when they refer to digital literacy as, it can be assumed, popular authors are likely to have a wider impact on public society than academic journal articles or monographs, which are literature that is more expert and therefore less widely read. However, such literature often shows a lack of rigorous evidencing, which is particularly apparent in Prensky's work below (Selwyn, 2009). This is not to say that all popular authors have lacked research to support their claims, but there is a noticeable difference between how authors like Tapscott and Buckingham (see 3.4) have viewed their worked and the intention for its dissemination and use. Unlike Buckingham's educational claims towards a realistic understanding of child digital literacy and its place in changes to the foundations of the educational system, Tapscott's work seeks to drive forward an industry that develops products and games for a younger generation. The influences of these separate industries (academic and business) can be seen to influence how child digital literacy is written about.

The contentious debate surrounding modern children and their differences from previous generations came about in the 1990s, with authors such as Papert (beginning of 3.1) and Tapscott (discussed below). The debate, however, really sparked off in 2001 when Marc Prensky declared that the generation of children currently in education were 'digital natives', fundamentally different from children of the previous decade in every way (Prensky, 2001). Since 2001, other authors have picked up this debate,[20] continuing the idea that modern children learn differently than their predecessors because of the impact of technology on their lives (see Oblinger, 2003; Gros, 2003;

[20] See Kennedy, et al (2008) for a discussion of the issues surrounding the perpetuation of Prensky's argument during the 2010s.

Doherty, 2005; Rodley, 2005; Gibbons, 2007). The fact of the matter is that Prensky, as an author, is a digital learning game creator and not an academic. His article appears to have been aimed at a more popular audience, and did not contain the same level of supporting evidence that would normally be found in an academic piece. Yet, in later discourse, he is often ascribed as the man that first conceptualised the differences in the 'digital native' generation, even though digital literacy was already a topic of debate (see 3.3). His topic was picked up by authors such as Palfrey and Gasser in their *Born Digital* (2008) book about digital children, which fully embraces the 'digital native' terminology, claiming that the late 20th century children were always connected and online, and often acted in a capacity as 'creators' within the digital world.

Though Prensky did, indeed, coin the term, his definition of 'digital natives' is little true in reality, as section 3.3 below will evidence. He was not, however, the only popular author to make such claims about the distinctness of the new generation. Tapscott (1999) calls them the 'Net Geners', children who have grown up with the Internet and he claims they use it 'naturally and easily'. To assign such claims to an entire generation, especially in the 1990s, when simply owning a computer with Internet access was a concept foreign to much of the world, is the type of claim the media will seize upon (The World Bank, 2014). Tapscott did make some attempts, specifically in his work in 2009 *Grown Up Digital*, to dispel the myths surrounding his Net Geners; myths that had made their way into popular discourse surrounding education (Kennedy, et al, 2008). These were the often-heard claims that children were overloaded by technology; could not communicate properly; could not live without being connected (Tapscott, 2009). Even current Ofcom (2013) media use reports show that not every child in the UK owns or uses a computer. To claim that all children are being drastically and permanently affected by technology is bold even today. At the same time, to claim that computer addiction and overload are in all cases myths is equally a bold statement. Tapscott (2009) suggests there are eight characteristics or norms that typify the 1977 to 1997 generation of children, explaining that adults need to understand these and educational needs to meet these characteristics. However, though Tapscott does attempt to better understand his generation of special children than Prensky did, he makes a similar oversight to the learning-game creator, in the assumption that all children of one generation are similar, no matter their background, and that technology access is not to be taken into account. Tapscott's background is in the business world, being a business

executive by career, and the focus in his writing would therefore be to appeal to that sector by offering suggestions to them on how different their new generation of employees is. The idea of an entire generation that fits into one categorical type of digital ability is, perhaps, not surprising, giving such popular works as Tapscott's and Prensky's.

More evidenced authors such as Oblinger and Oblinger (2005) also make claims regarding the necessity to change educational systems to support a new type of child: making school learner-centred, meaningful and constructivist in its approach, to instruct a generation of technology children. However, unlike the authors above, the *Educating the Net Generation* report is more moderate in its views of the abilities of the young generation and remind the reader that technology is not the solution to all problems; children still need to be taught face-to-face in order to learn fully (*ibid*). In this particular section of literature we find the more moderate realistic debate, which provides a measured view in opposition to the optimistic authors such as Tapscott.

It is, perhaps, not unsurprising that the medium of blogs and news articles both agree and disagree with the digital natives debate, digital literacy definitions, and the need for change, or not, in education for new generations of children. After all, the Web itself is one of the most contentious parts of digital literacy and bound up with an attempt to understand what role the Internet plays in being literate in the 21st century. The Internet, with its publically accessible (and changeable) content, lacks the need of rigorous evidencing as an academic journal article would. That is not to say that all information on the Internet is incorrect, but it must be viewed with a note of caution and a high level of digital literacy ability to critique the information found there. In light of this, how can a reader searching for information understand what is factual and what is not? There is a larger issue within this, however, for it is through the Internet that parents, teachers, children and those whose roles are within the digital world can easily find their information. If this information they rely upon is biased or outwardly incorrect, then it may be perpetuating the assumptions about a digital generation who think differently, learn differently, and have different needs than the children of previous decades.

In the UK, articles relating to digital literacy and technology use by children can often be found on such news websites as the BBC's. A publication by the BBC News' health reporter in April 2013 provides an example of the type of discourse. The article issued a warning about technology use by toddlers. Quoting research from the University of Wisconsin, the article acknowledges that 'children aged between two and three were more likely to respond to video screens that prompted children to touch them than to a video screen that demanded no interaction' (Roxby, 2013). The research found that 'kids who are interacting with the screen get better much faster, make fewer mistakes and learn faster' (Heather Kirkorian, quoted in Roxby, 2013). The article then goes into a counterargument, citing research by other academics who claim that technology use in children should be curtailed 'because it could lead to addiction or depression' (Aric Sigman, quoted in Roxby, 2013). However, the various authors cited in this article each have their own opinion on screen times and what technology can be used for, creating a confusing conglomeration of options for the average parent choosing to read the piece. Indeed, the article ends with the declaration that perhaps children 'just want to enjoy technology the way adults do' (*ibid*). This sort of confusing online information is no doubt perpetuating the struggle that those who educate and deal with children are facing when understanding what digital literacy is and how it manifests itself.

These types of messages that oscillate between (and sometimes blend) the realist and optimist discourses are popular in the mainstream news reporting about children and technology. It seems that, for every article that expounds how useful technology is to children and their learning, there is another article that warns against information overload and screen addiction. For example, the online student newspaper HomePage Daily, published an article by one of their bloggers entitled 'The Internet Generation', giving an overly optimistic look at children and their appropriation of technology, while failing to cite any academic or educational research on the topic. In the piece, the author, Simon Moore, claims that 'youth are re-evaluating problems and looking at them from multiple perspectives, they read more except they read off a computer screen, they educate faster due to more accessible and entertaining learning processes' (Moore, n.d.). Such an optimistic view, with no source material, is diametrically opposed to the academic authors, such as Buckingham, who expound at length that children today are worse at multi-tasking, problem solving, critical evaluation and factual learning than ever before, using several years of study and research

(Buckingham, 2000, 2008; Livingstone and Bober, 2005). However, such individuals as parents, new teachers, and museum staff are confronted rather with the discourse of the mainstream media. The predominant Internet opinion purports that children should both be protected at all costs from the negative influence of technology as well as allowed to demonstrate their innate ability to use it. If the views of digital and media literacy in their own fields are contentious, these popular dichotomies are not making the issue easier for members of the public to understand.

3.3 Media Literacy

We now move to consider how the academic field of theory has viewed digital literacy, and here we must explore a longer history of the origins of modern digital literacy and its fields of study. We begin with a general understanding of the new literacies that have come into the theoretical discourse since the prevalence of technology, the first of which is media literacy. Media[21] literacy as a term originated in the 1980s and comes from the field of media education, not specifically relating to computers or digital. It often has a wider definition, which encompasses all media and therefore future changes in technologies (Erstad, 2010: 58). It had since been appropriated into educational discourse, leading to several decades of research into the impact of it in schools (Drotner and Erstad, 2014). This research has focused on understanding how students use media in their education and, in turn, what effect this has had on the educational system (*ibid*). Over the decades, media studies, and media literacy research, has come to focus more specifically on the user (whether student or other) and how they engage with media, their everyday media 'practices' (*ibid*). However, it must be understood that 'media' in this research covers all types of media, both analogue and digital (*ibid*). As such, media literacy has many definitions, but is generally viewed as 'the ability to access the media, to understand and critically evaluate different aspects of the media and media content and to create communications in a variety of contexts' (European Commission, 2007). Media literacy can therefore come in a range of levels, from a basic ability to use media, through critical engagement into creative use and understanding of wider media issues, such as the media economy and digital culture (Koltay, 2011; Erstad, 2010). This definition is the most encompassing for media

[21] 'Media' here refers to all types of information presented through a mass medium, including television, images, print, radio and the Internet. It is not to be confused with 'media' as a solely digital construct.

literacy, as often the definitions do not include creational concepts, but focuses rather on the ability to creatively evaluate.

Several authors prefer a slightly different view on media literacy (or other literacies), purporting that to be accurate we need to speak in terms of multiple literacies (media literac*ies*) to cover the widest range of both media and types of learning (levels of literacy) (Buckingham, 2003; Drotner and Erstad, 2014). The idea of multiple literacies allows for the use of media literacy in various areas of study: policy, practice and academic, as Erstad and Amdan (2013) categorise it. Within each of these areas are different understandings of media literacy, making one overall definition problematic. For example, in policy, as Erstad and Amdan suggest, media literacy focuses on media access and communications ability, lacking a focus on critical understanding (*ibid*). Instead, Erstad and Amdan suggest a different approach than these disparate views: a view of media literacy as progressive levels that incorporate the views of policy, practice and academic definitions, under which each view can fall, or straddle (*ibid*).

'Personal skills and competence' allow users to develop critical skills through education, this includes having access to technology, the skills to operate it, and the understanding to analyse and evaluate information through media, as well as produce or create to actively participate in that media (*ibid*: 89-90). It is under this that 'policy' most specifically falls. Next in the level approach is 'social interactions and practices', which gives users an understanding of the social context of media, allowing them to participate by pursuing their own further learning and making media part of their everyday lives, within a social group (*ibid*: 91-92). It is under this that 'practice' is encompassed. The last level is 'media systems and contents' which is the focus of media education, interested in how users interpret content and their wider appreciation of media (not just their use of it). This level also includes an understanding of media systems and their production and the people who produce them (i.e. media education). Therefore, at this level, media is the subject matter of study (*ibid*: 92-93). These specific levels allow all definitions from policy, practice and academia to sit within one overall understanding of media literacy, while also showing that the term is more complex than one simple definition, such as the European Commission's (2007) can show.

As is seen, media literacy as a concept is complex and evolving, based on the media available to users, as well as the appropriation of literacy concepts by different areas of research. Tied closely to media literacy is the theory of digital literacy; however their development is different and digital literacy has emerged currently as the most commonly used term in UK discourse. It will therefore be discussed below in more depth than media literacy, as it is the theory that most directly impacts the research of this research project.

3.4 Digital Literacy

Since the 1990s, digital literacy, which began in the computer science field, has been caught up in the discussions surrounding media literacy and has now become the predominant term to discuss children and their technology use (Erstad and Amdan, 2013: 86; Ferrari, 2012). Digital literacy is now seen as a life skill, something in which every child needs to participate in the 21st Century world (Buckingham, 2009: 17). Digital literacy, unlike media literacy, did not evolve from media education, but rather from the concepts of computer literacy in the late 1970s that detailed the ability to use a computer in working life (Martin, 2003). After computer programming was no longer needed to be able to operate a computer system, as computer interfaces became more simplified and accessible, computer literacy became more about using applications and software programs (*ibid*). By the 1990s, it was realised that this focused definition of computer literacy did not really define the issues at the time, and ICT literacy came to the fore, which included for the first time an ability to not just use ICT, but also to evaluate the information through it and create using it (*ibid*). In 1997, the field of study of new literacies changed, with the publishing of Paul Gilster's *Digital Literacy*. The term 'digital literacy' was quickly taken up, though from its inception it included several definitions that broke down into various competencies of digital literacy (Gilster, 1997: 2-3; Bawden, 2008). The term is considered deictic; it changes continuously based on various factors including the public discourse, new academic studies, and changing technologies (Ferrari, 2012).

However, it is from Gilster's work that other authors have attempted to formulate their own, more specific, definitions. Even so, today digital literacy 'is still not well understood as a discourse', even more than media literacy, and its presentation as a set

of skills is usually focused on the understandings needed by a person to become a full member of the 21st century (Marty, et al, 2013: 409). As such, the concept of digital literacy has been heavily bound up with education, and how schools can teach a set of digital skills to children (Meyers, Erickson and Small, 2013). Sefton-Green, Nixon and Erstad warn that a focus on digital literacy and education is problematic, as formal education is not necessarily responsible for child digital literacy developments (2009; also McPake, et al, 2008; Drotner, 2008). More recent authors since Gilster have argued that digital literacy is, rather, formed of various skills, or sub-skills, leading to such authors as Eschet-Alkalai's five literacies and Hobbs' five digital literacy abilities (Eschet-Alkalai, 2004: 94; Hobbs, 2010: vii-viii).

The debates surrounding digital literacy have continued over the last fifteen years, tied into the increase in children's digital use in the UK. The 2013 report by Ofcom suggests that 90% of 5-15 year olds in the UK have home Internet access and 80% of them make use of it. Mobile phone ownership increased from the last report in 2011 (Ofcom, 2013: 3). What is more telling is that parents surveyed for the report felt their children often knew more about the Internet than they did, and that sometimes their children even assist them in online skills (Ofcom, 2013: 4). Significantly, of those surveyed, 88% of children aged 8-15 said they felt more confident in their ability to protect themselves when online than in previous Ofcom reviews (*ibid*: 7). Even 84% of parents agreed they were more trusting of their children's ability to be safe in their Internet use, demonstrating that both children and adults believe there has been an increase in child digital literacy since the last Ofcom report (*ibid*: 12).

As the prevalence of technology has increased across the UK, as well as the world in the last decade and a half, so has children's access to it, as can be seen in the Ofcom report cited above. This means that not only have children been exposed to more types of technology (from tablets to smartphones and beyond), but that more children now have access than even a decade ago, especially to the Internet. According to Bawden (2008), the biggest change in academic discourse over the last fifteen years has been the move from discussions of digital literacy as a set of technology skills in the use of software and hardware to a focus on the ability to critique information. Bawden now terms this a 'crucial ability' in a world where digital information is not just more easily available, but also now a requirement for the individual to uncover and analyse

information on their own, rather than having the important aspects delivered to them, through media, education or literature (*ibid*). Buckingham views this as a step up from traditional literacy, which focuses, at its deepest level, on how to critique information and, in turn, use that to construct an argument (2010: 9). Traditional literacy must be mastered first, and then the same skills can be used digitally to develop digital literacy.

It is now commonly suggested that digital literacy is made up of various aspects or levels. Each author has his or her own version of this conglomerated definition. It always includes technical skills as the foundation on which digital literacy can be built, but forming only a small part of being 'digitally literate'. In other words, the focus on children learning to use digital devices and the Internet is a small part of their journey to becoming digitally literate citizens of the 21st Century. The other change since the millennium has been the development of understanding digital (or media) literacy as multiple literacies. This stems from the idea that with so many technologies available, and so many uses for these technologies, a single digital literacy concept cannot cover them all. It is also born out of the many literacies that accompany digital and media literacy, such as computer, information, ICT and visual literacy. Allowing for multiple literacies encompasses a much wider definition that is adaptable over time.

There are several authors that have been predominant in the field of digital literacy, both in their breadth of research and their impact on other authors. Of those authors that discuss digital literacy and media use in the most heavily educational terms are David Buckingham and Julian Sefton-Green. These two authors have both written extensive works since the 1990s in an attempt to understand how children are actually using media in their everyday lives and how this impacts on formal learning. Their research suggests that children, most often, use technology for fairly banal uses, such as instant messaging and email, rather than advanced creative productions (Sefton-Green and Buckingham, 2004; Buckingham, 2006). This research is in stark contrast to the claims about how ICT in schools will achieve high educational aims, and also how children are innately adept at using digital technologies. In fact, Buckingham's research has found that children often lack engagement with educational technology as they see it as limited or uninteresting (Buckingham, 2006). These two authors sit in a more realistic camp of academics, whose work is focused on developing a firm understanding of

children and their digital and media literacy abilities that is helpful for the formal educational system in the UK.

Along with this educational focused research are several authors who have developed interesting definitions of digital literacy that encompass the widest, and more useful, understanding of the theory. The most detailed definition is by Eschet-Alkalai (2004), who proposes a multi-literacy understanding of digital literacy. In his view, photo-visual, reproduction, branching, information and socio-emotional literacies are all part of being digitally literate. As well, Eschet-Alkalai's research has charted an important distinction that other authors have not, in that adults are better at certain aspects, while children excel at others, suggesting an opinion that it is difficult for children or adults to be completely digitally literate without extensive instruction (*ibid*). This multi-literacy theory is also supported by Bawden (2008), Shapiro and Hughes (1996), Martin (2006), Sefton-Green (Buckingham and Sefton-Green, 2004) and Drotner (2013).

This echoes back to the development of digital literacy in the 1990s, and the literacies from which it came. The most predominant of these is ICT or computer literacy, which developed with the advent of computer use. Both literacies had very technical definitions associated with skills developed, rather than the critical literacy focus of current digital literacy definitions. Computer literacy dates to the 1960s (or more accurately to the 1970s), and is specifically about the skills needed to use a computer in one's life and work, but comes of an era when programming was still a large component of computer use (Martin, 2003: 157). This led to a change in terminology to ICT literacy, which was more concerned with using a computer to communicate, or basic competencies rather than specialist knowledge (*ibid*). ICT literacy today is still seen as a skills-based literacy (Ferrari, 2012). Also tied within these literacy discussions is information literacy. This literacy does not specifically refer to any type of technology or media, unlike the others discussed here. Rather, information literacy comes from the area of library sciences and is the ability to locate and analyse information in research (i.e. information found in a library) (*ibid*). Is it this, focused on critical engagement with information, which has become tied into the ICT and computer literacy definitions, to lead towards digital literacy, a meeting of all of these diverse literacies. This background evolution, which includes technical oriented

literacies as well as critical and cognitive ones, is seen in the modern concept of digital or technological multi-literacies.

The various literacy terms, whether media, digital, computer or visual, have been caught up within the educational field throughout their lifespans. Technology has been appropriated by education as a tool to assist in traditional learning styles, where knowledge is passed from teacher to pupil (Drotner and Erstad, 2014). In the early days, technology (ICT) was seen as a solution to many of the problems encountered in the traditional education system of the late 20th Century (Selwyn, 2002). On its own, technology cannot solve the problems of the education system, but by developing an understanding of new literacies, technology could become something more than just a tool to perpetuate the traditional system.

3.5 Digital Competence

In Europe, digital literacy is often termed digital competence, as in several languages 'literacy' does not translate (Drotner and Erstad, 2014). Within northern Europe especially, the term is linked with formal education. This terminology has been picked up in the UK and fits in well with the long-standing debate on what 'literacy' actually is, when it is imposed on digital, computers or new media. Digital competence is one of the eight key competencies defined by the European Union's Lifelong Learning goals, which give a list of what a person needs to be able to function fully in the 21st Century (Ferrari, 2012). It is therefore defined as the:

> [s]et of knowledge, skills, attitudes […] that are required when using ICT and digital media to perform tasks; solve problems; communicate, manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming and empowerment. (Ferrari, 2012: 3)

This European Union definition is the widest discussed in this chapter, encompassing all aspects of digital and media literacy, as well as digital competence. This agrees with other authors, who see digital competence (as digital literacy) to include basic

skills in life use of ICT, as well as wider understanding of issues such as privacy, copyright and online security (Ala-Mutka, Punie, and Redecker, 2008; Søby, 2013). Digital competence has also entered the mainstream discourse as a concept, appearing in reports and even personal blogs. Unlike digital literacy, digital competence seems to be understood on a more cognitive level; that although children can 'appear' to be competent with technology, that does not mean they are able to critically engage with it (Geek Dad, 2011; CIBER, 2008; Buckingham, 2010). Perhaps in the UK, the word 'competence' is one better understood than 'literacy', which can have a confusing definition when correlated with technology. Literacy is, after all, focused on the ability to read and write, and for a person to be able to use the Internet or a computer with ease, the basic set of skills, they must already be 'literate'. Digital literacy then is a problematic term (as well as all other new literacies) as it builds upon an expectation. What then is being digitally literate if a person is already literate? This has been the focus of the debate upon both the definitions of new literacies as well as the debate on a deeper understanding of what they actually are. Digital competence, however, does steer clear of this heavily contentious issue, as it does not rely on the underlying problem with the term of 'literacy'. Competence can be defined on its own, with a much less controversial history.[22]

Perhaps then, discussing this research in terms of digital competence, as it is understood in Europe, presents a less problematic theory. However, digital competence is not (as yet) a popular term within the UK. It is the contentions within the digital literacy field in the UK that have lead to the incongruent understandings between government, education, parents, museums and even children. It is this nuanced understanding that has formed the background of this study, and therefore we move forward from this to the rest of the chapter and into the field data analysis.

3.6 Summary of the Varying Discourses

In light of the various issues within the field of literacies and technology, there are several points to summarise in detail. The first is to look at each literacy from the perspective of its determining factor: either technology drives the literacy or

[22] The Cambridge Dictionaries Online defines competence as 'the ability to do something well' (Cambridge University Press, 2015).

competence does. In the case of media literacy, competency is the clear factor of importance to researchers and educationalists. However, for digital literacy, both competence and technology have driven the debate, depending on the definition expounded. The use of competencies, that is the higher cognitive understanding and knowledge surrounding the use of the digital, is the key factor for those researchers (such as Buckingham and Sefton-Green) who believe access is only the first step towards digital literacy. Technology as a determinist factor aligns more with authors that are optimistically oriented in their views, who see digital literacy as something that can be inherent with the use of digital.

Also within the discourses of media and digital literacies are the dichotomies between the location of learning, whether it is formal education, informal personal learning or, as Drotner (2008) emphasises, somewhere in between (semi-directed learning such as might be found in a museum). Media literacy, coming from the field of media education is, of course, very centred in formal education, though not completely. Digital literacy, which comes from a field where professionals expounded computer literacy, can often be less centred on formal learning. This is especially prevalent in situations where digital literacy is concerned first and foremost with access and communication ability, which are more within a public sphere than an educational one.

For the purpose of this research project a single concept of digital literacy is difficult to devise. However, several key understandings of the field since 2000 are obvious. For one, technology has evolved to include many more options now than a decade ago; there are more types of hardware and software options. As well, more people now use digital devices than a decade ago; it has become more prevalent, including amongst children. Digital literacy research, in all its forms, emphasises these changes, as well as an increase in understanding how children actually use technology in their everyday lives and how they learn from it. Digital literacy is now a concept understood as something that is often learned outside of formal schooling, to be continued in education to a digitally literate level through cognitive engagement. The old focus on digital skills, such as through ICT or computer literacy, has now led to a larger concept of digital literacy as a strategy where skills are only the first step towards becoming a full citizen of the digital world.

In academia and the field of children's education, digital literacy is focused on the ability of a person to use, understand, analyse and evaluate information found through technology. The focus here is on cognitive understanding over the ability to access the information in the first place. Recently, a further move towards digital literacy as the ability to communicate that cognitive understanding with others and to create information itself has come to the fore. In its simplest current form, digital literacy can be understood then as the ability to access, evaluate, and critique information and communicate it using various forms of digital media. This means that younger children would find it more difficult to be considered digitally literate, whether they are able to engage with game apps on a tablet or not. However, an adolescent researching a project for a school course using online sources may be no more digitally literate. This issue will continue to occupy the education sector until an agreement can be reached as to how digital literacy skills should be taught to children in order that they might be considered digitally literate by the time they enter the job sector. Because of this, the issues of digital literacy will also continue in popular media, and by parents and informal educational centres, such as museums and art galleries. How digital literacy is seen amongst this second group of individuals, outside of both academia and formal educational research, is outlined below with special regard to museum institutions.

3.7 Conclusion

This chapter has presented a theoretical perspective of digital (and other 'new') literacies. Its focus has been to understand how this wide-ranging field can be used in this particular research project, becoming the theoretical underpinning of the data collected, as well as the original conceptual idea. It has accomplished this through providing a theoretical framework in which to uncover answers to the research question of what assumptions museums are making about child digital literacy in their work.

Digital literacy is a difficult subject to define, but is mainly understood as a personal ability to access, evaluate, and critique information and communicate that information using various forms of digital media. Within this is understood the technical skills to use various devices, and the critical thinking necessary to engage with digital data in a person's daily life. Museum staff at the case study institutions do not readily understand this definition of digital literacy, as this thesis will demonstrate; however it is their

preconceived notions of children today and their technical abilities that have informed exhibition design for over a decade. The dichotomy between the two, nearly opposing, views of realistic and optimistic digital literacy has lead to a variety of issues in missed intentions and misunderstandings in digital gallery interactives. That optimistic discourse in digital literacy reflects a view that children are innately capable users of technological devices and that, indeed, such use increases their engagement and learning, but is contrasted heavily in realistic articles where research examines children's lack of digital literacy and the overall need for proper digital instruction. To reflect on these issues and the changes that have taken place over the last fifteen years within this discussion will put UK museums in a better position to move forward in a rapidly changing technological world.

Chapter 4: User-Centred Design Theory

4.0 Introduction

We have now walked through a discussion (as seen in Chapter 2) on how the museum sector has provided digitally for children, and how assumptions[23] within those provisions might be questioned in terms of this research project. Subsequently, in the previous chapter we have explored a discussion of child digital literacy that proposes that there are two dominant discourses in the field (optimistic and realistic views of digital literacy) and that both are varied and in opposition in their opinions. It is these two dominant discourses which may now be used to explain, at least in part, the design assumptions about children made by museums in this study. With these two discussions in place, we now turn to the third context for this research project, that of design, and its place as a method of data analysis.

The data collected for this project was influenced from the beginning by the digital literacy theory presented in the last chapter, but reviewed and analysed from within the field of user-centred design, presented in this chapter. The use of these two fields of study within a museum-centred research study provides a unique look at two developing sectors and the possibilities of more multi-disciplinary research between them. This chapter examines the history of user-centred design within a museum context, as the previous chapter did within the history of digital literacy. This chapter focuses specifically on processes of design and their applicability to the design of museum interactives in their multiple forms. It does this for the express purpose to understand, in a practical way, the qualitative data from the case study museums. Museums' understanding of design theory is almost as varied as their understanding of child digital literacy, but the two are entwined together in the creation of each digital exhibit.

Designing computer-enabled systems for users is a complex field. It is complex in that it is a meeting of multiple fields, many of which are new and evolving, and that each field has its own focus and set of principles. This study used the principles and

[23] That technology will attract children to the museum, and that it will allow them to learn in new ways that cater to various styles, thereby providing an educational visit that is also enjoyable.

processes of designing user systems to analyse and explain the design processes of the museums interviewed during field research. It presents a group of terms most apparent from the field of design that are generalised enough to represent the practices found within museums, though the museums themselves may not overtly make use of the self-same terms. The field of user-centred design is then appropriated as a framework, using its common processes, to inform and direct the analysis of the digital design in the case study museums. In Chapters 6 and 7, the design processes discussed in this chapter will be used as an outline in which to analyse the digital literacy assumptions by staff at the museums in this project. Specifically, the four-step design process highlighted in this chapter (of 'requirements-design-prototype-evaluate') will separate the assumptions made by staff into each step in design to differentiate where the assumptions have been made and what impact that has made on the design of the interactives. As well, this chapter also provides a basic language for speaking about interactive design so that the reader might better understand the processes and types of design discussed in this thesis. This is particularly important, as we will see in Chapters 5, 6 and 7, as individual museums have their own language that has been created based on their staff knowledge. A list of terminology presented here will be applied to the museums and staff assumptions to make the design process clearer to the reader.

The use of theory from another field of study allows this research to apply those individualised practices and processes to a single, accepted, type of interactive design. According to Dean (1999), there is a regular set of phases through which museums design exhibitions: conceptual phase, development phase, functional stage and assessment phase. However, in actual practice these stages (or phases) move and change and are adapted by each museum to suit their own needs. A wider understanding of these practices within their own field is needed to better trace these differences and individualisms within institutions and to understand how those changes affect the ultimate design. Museum exhibition design must be holistic, allowing for successful collaboration between staff, in order to best meet the visitor's needs (Grasso and Morrison, 1999).

4.1 Design

Human-computer interaction (HCI) for digital systems is complex, as this chapter will demonstrate. It is a field of study, which has changed over time as the understanding of computer systems has evolved, and as computer systems themselves have evolved. As well, HCI is individual to designers, as the authors presented here showcase, and though a basic understanding of the subject is clear, the more nuanced parts of HCI are dissimilar for individual designers. Recently, HCI as a field of study has rapidly expanded to include many other areas of study, such as sound and architectural design, owing to the rapid and continuous development of new technologies. The history of HCI and its more recent development are presented here for the reader to gain an understanding of the background of the field before moving on to a discussion of HCI processes and components.

A starting point for understanding this complex mixture of fields is Dan Saffer's *Designing for Interaction*, where he politely titles the section 'A Stew of Disciplines' (2010: 20). Saffer is familiar with both the academic side of the disciplines, and has worked in the industry and with many designers over his career; as such he is in a strong position to reflect on the field of designing for users. The larger field of designing interaction systems is very much a stew, as Saffer suggests, with each 'flavour' competing within the meal. Saffer includes a visual representation of his proposed 'stew', which showcases how each discipline fits within and against the next (See Figure 4.1). According to Saffer, 'user-experience design' (UxD) is the largest and most encompassing of the disciplines, and under which almost every other discipline falls, at least in part. Contained within this larger field is 'interaction design' (IxD), and overlapping both, but also outside of both, is 'human-computer interaction' (HCI) design. These three disciplines form the main elements that make up designing interactions in this age of computers. Within and without them are other, smaller disciplines, such as 'visual design' and 'industrial design' (Saffer, 2010: 21). For the purposes of this study, however, the three main disciplines, HCI, ID and UxD are the most applicable.

Figure 4.1: Saffer's 'Stew of Disciplines', Saffer, 2010: 21. Image removed due to copyright restrictions. Can be found at: http://www.kickerstudio.com/2008/12/the-disciplines-of-user-experience/

All three are new. The history of modern computer systems as we know them today is short; they were developed over only a few decades from the 1950s (Manovich, 2001: 71). All of Saffer's proposed fields of study date no earlier than this. Though Saffer's book specifically focuses on 'interaction design', he does give an overview of computer design since the 1950s. Saffer's choice of 'interaction design' comes specifically from charting the history of the discipline since its official founding by Bill Moggridge in 1990 (Saffer, 2010: 2). Saffer explains that 'interaction design' has been around far longer, suggesting even back to pre-recorded history where early people communicated through symbols on the landscape (2010: 8). What followed in the 1800s was Morse code, which required a system to run it; hence 'interaction design' was required (Saffer, 2010: 9). Though computers, in some form, date back to World War Two, it was not until the 1960s that the idea of designing computers for users, not just for tasks, became a practice (Saffer, 2010: 11). This early design was still characterised as very scientific, or technical (Benyon, Turner and Turner, 2005). But it began the era of the user interfaces, a way for the user to communicate with the system and followed in the 1970s by a focus on software over hardware (Saffer, 2010: 13). It was Apple in the 1980s that created graphical user interfaces on personal computers, allowing individual

users a personal relationship with their device (Saffer, 2010: 14). As Saffer explains, the formal discipline of designing interactions did not begin until the 1990s, at the same time that the World Wide Web launched publically. There were new ways for users to communicate with the device, but also other users (Saffer, 2010: 16). The computer, however, was still an obvious piece of technology, something in many ways more complex than today's computers. There was a push to make the computer disappear so that users no longer needed to concentrate on the device, but rather what they were doing with it (Norman, 1988: viii). Over the last fifteen years technology has developed to a stage where the user communicates with multiple devices and does so in gestures rather than commands; it is the era of the iPhone. Benyon, Turner and Turner call this the time of the 'convergence of communication and computing technologies' (2005:16). Naturally, things take time to become popular and understood. The field of user-experience design is still evolving, as this chapter will show.

Saffer treats user-experience design (UX, also UxD) as an umbrella term; one in which all other disciplines fall, because it is concerned with the factors of those smaller disciplines (2010: 20). As Saffer explains, 'The best products involve multiple disciplines working in harmony' (*ibid*: 22).

All disciplines take time to evolve into a single practice accepted by academics and practitioners. The sub-disciplines of UX are just reaching this stage and it has come through a complex route since computers first entered the workplace in the 1960s. They came from the understanding that computer systems were not developed to control people, but that people should control the system to assist them in their work and lives (Norman, 1988: x).

4.2 Terminology

Under the umbrella terms of 'user-experience', 'interaction design', 'human-computer design', and a host of others, is a lexicon that refers to principles, practices and processes within the fields. There is some overlap amongst these disciplines, which is discussed below. Rather than a complete overview of the entire field of design, terms presented here in this summary encompass the aspects of the field most useful for this particular research study. Consequently, our first discussion will focus on human-computer interaction design, user-centred design and interaction design, and explain the

pivotal terminology within these main sub-fields.

4.2.1 What is Human-computer Interaction?

Of the two largest disciplines falling under Saffer's UX (user-experience) is 'human-computer interaction'. This is one of the older disciplines and dates back to the 1970s (Imaz and Benyon, 2007: 4). The term is most associated with Ben Shneiderman (1987). According to Shneiderman, 'human-computer interaction' (HCI) was originally a non-formalised discipline that was characterised by what designers did in their own projects. The formalization in academic practice came later (1987: 27). Along with the formalization in the 1980s, the focus of HCI began to change: it no longer saw humans as information processors similar to computers, but rather a dialogue between humans and computers (Imaz and Benyon, 2007: 14). Today, that field has evolved further and is now no longer focused on a dialogue between the two, but 'direct manipulation' by the human to the computer. Shneiderman, however, coined the term 'direct manipulation' in the 1970s, when computers were operated by lines of code and early windows (Imaz and Benyon, 2007: 103) Our current level of technological use has seen the reduction in screens – we no longer need a large visual display in order to interact with the system, but can now rely on specific gestures and touch to manipulate computers (*ibid*: 16). HCI is now, according to Imaz and Benyon, about 'getting people, activities, contexts, and technologies to sing in tune' (2007: 105).

4.2.2 What is Interaction Design?

Unlike HCI and UCD, I(x)D or 'interaction design' are both popular terms within a variety of prominent publications in this area (Graham, 1999; Crawford, 2003; Benyon, et al, 2005; Cooper, et al, 2007; Moggridge, 2007; Rogers, et al, 2011). Many of these publications are recent and though they discuss their own version of Saffer's 'stew of disciplines', they all centre on 'interaction design' or 'interactive design' as the most integral to their work. Rogers, Sharp and Preece define their version of IxD[24] as 'designing interactive products to support the way people communicate and interact in their everyday and working lives' (2011: 9). No longer is the focus on the dialogue

[24] For the purposes of this thesis and to avoid confusion, IxD will be used to refer to Interaction Design, though ID is a popular acronym as well.

between the human and the computer, as in HCI, but rather how computers can help the dialogue between people, in the way that Apple has designed the iPhone to increase human-to-human communication on multiple platforms. According to Rogers, Sharpe and Preece, their 'interaction design' is the umbrella term. Cooper, Reimann and Cronin, publishing in 2007 agree with this sentiment. Their second edition of *About Face* used the term 'user-experience' in 2003, but changed to 'interaction design' in the 2007 third edition (xxix). Cooper, Reimann and Cronin define 'interaction design' as 'what a digital product *is* and what it *does*'; taking a focus that is more concerned with the product foremost and with its communication ability as well (*ibid:* xxx). They also consider 'user-experience', in their 2007 edition, to be out-dated and too broad to discuss the actual design of interactives. Their own work is based on Moggridge's version of IxD. Moggridge, with Gillian Crampton Smith, are commonly held to be the pioneers of IxD theory, based in the UK, according to M. Mason (in an email 29 September 2013). Moggridge's *Designing Interactions* is a collection of interviews with the key figures in the field, and is quick to point out that it is about a young field, with a still evolving language (2007: xvii). This can explain some of the inconsistency amongst authors in the last twenty years, who each have their own definitions of the terminology as well as their own preferred term.

The main methodology in IxD is 'goal-oriented design' where the designers, instead of focusing on designing a series of tasks for the user to reach a goal, design for the goal itself (Cooper, Reimann and Cronin, 2007: 14-15). Within this, researching the user is integral to the process (*ibid:* 20). This is very similar to the next term, UCD, discussed below.

Saffer also suggests that there are multiple types of IxD. He gives four options, the first of which is basically a form of UCD. The second type of IxD is 'activity-centred' where the concentration in design is on a series of certain tasks the user performs, but where the user is not the focus. The third is 'systems design' that is about context design and is often used for complex systems where the system is the focus, not the user. Finally, 'genius design' is the fourth of Saffer's four types of IxD and is about the designer. This term is Saffer's own and it details that the design is based on the designer's experience and skills. Designers 'use their best judgment as to what users want and then design the product based on that judgment' (Saffer, 2010: 43). Saffer

points out that, despite the fact this type of IxD sounds more informal, it is the most common one in the current field, either by choice or necessity (*ibid*: 43). The necessity is important for museums, as few have the time and resources to do user research or testing, making genius design the main form of design in the cultural sector. Incidentally, Apple also uses this form of IxD (*ibid:* 43).

4.2.3 What is User-centred Design?

The field originates with Norman in the 1980s who defined UCD in his *The Psychology of Everyday Things* (*ibid*). Norman (1988: 188) suggested that UCD focused on making the system easy, making the interface visible, making it possible to evaluate the system and to ensure that there is a logical progression between the user intention and the required action with feedback to the user. Shneiderman provides similar rules for UCD, but Norman was the first to write on the subject, stressing the importance of the user in the design (Abras, Maloney-Krichmar and Preece, 2004). User-centred design is not a term that Saffer incorporates in his diagram, but it should be included in terms of this study, because it is frequently used by other authors to fit within IxD and HCI. It is more specific and is concerned with users influencing design (Abras, Maloney-Krichmar and Preece, 2004). It is not a top down approach, but a bottom up field where the user lies in the centre of the design. Abras, et al (2004), term this specific type 'participatory design', signifying that the user is involved in development phase, not just the testing phase. The user can be involved in design in a variety of ways, but the important aspect is that they must be involved. This has become particularly common in Scandinavia (*ibid)*.

Eason suggests that within UCD, there are three forms that dictate how involved the user is: design for users, design by users, and 'design for users with users' (Eason, 1995: 1667). The most involved a user can be is in the last category, which Eason also calls local design, where the user is entirely in charge of how they personalise a device; this is most specifically seen in the iPhone. Much of UCD is accomplished with design for users, where user behaviour is researched and understood and then designed for, however this does not allow users much say in what the ultimate design becomes (Eason, 1992: 3).

A field that moves back and forth between different terminologies may at first appear to lack consistency and clarity. However, each of these three terms has an important difference in its focus and meaning and a different role to play under the umbrella term 'user-experience design'. HCI, IxD and UCD all form part of this larger field and are responsible for different aspects of the overall design. Each of these sub-fields has their own terminology. For the purposes of this thesis, and concerning museums specifically, the terminology within IxD, UCD and HCI often overlap.

Within IxD, 'interactivity' must be defined as referring to the media that allows user interaction (Graham, 1999; Manovich, 2001). It can be explained in terms of levels of interactivity (Graham, 1999: 20). Rogers, et al, also give levels of interaction in their book *Interaction Design*, suggesting that users can 'instruct' the system, 'converse' with the system, 'manipulate' a virtual space, and finally, 'explore' by moving through a space such as a 3D world (2011: 47).

To achieve these levels of interaction, Interactive design must be defined as simply 'the meaningful arrangement of … [media] … in an interactive document' (Graham, 1999: 4). Interactive designers are those people who design all aspects of interactives (*ibid:* 4). 'Design' is therefore defined as 'the creative process of specifying something new and to the representations that are produced during the process' (Benyon, Turner and Turner, 2005: 11). Interactive designers design the arrangement of media to form an interactive document, or system (*ibid*). The systems can be complex or simple, but these days it should be invisible, with only an 'interface' obvious to the user to allow for interaction (Benyon, Turner and Turner, 2005: 12; Imaz and Benyon, 2007: 15). The interface allows for direct manipulation by the user. 'Direct manipulation' is a term originating with Ben Shneiderman in the 1970s to differentiate new computers that used windows from older ones that used code for access (Imaz and Benyon, 2007: 103). We use direct manipulation today to operate a tablet computer, but the idea of using symbols and gestures to represent commands and programs was well entrenched in early computer design (Hutchins, Hollan and Norman, 1986: 91). Shneidermann breaks down direct manipulation into a six-part definition. Systems that use direct manipulation as their interface must be easy to learn, quick for experts to use, easy to remember commands, give immediate feedback, reduce user anxiety and do away with error messages (Shneidernman, 1982: 251). These were the founding understandings of

modern interactive technologies and will be considered in more depth in the following section, which discusses the aims and objectives of IxD and UCD, specifically, beginning with an overview of the structure that encompasses them.

4.3 Components of IxD

In 2001's *The Language of New Media*, Lev Manovich stated the following:

> in contrast to cinema, where most "users" are able to "understand" cinematic language but not "speak" it (i.e., make films), all computer users can "speak" the language of the interface. They are active users of the interface, employing it to perform many tasks: send e-mail, organize files, run various applications, and so on. (Manovich, 2001: xv)

Today, users would struggle to "understand" computer language in all its complex forms, many of which were discussed above. However, a user who owns a computer can "speak" to it and interact with the interface in a way that benefits them. This is because the aim of UxD is to ensure a user can do exactly that. They don't have to understand the deeper levels; the user just has to be able to speak a simple level of language that can command the interface in the ways they need it to work.

However a user interacts with a system, Norman explains that problems can easily exist within the interface through which the user "speaks". He defines this as the Gulf of Execution and the Gulf of Evaluation (Norman, 1988: 51). These deal with the differences between what a user thinks they can do and what they can actually do with an interface of a system. The first, the Gulf of Execution, can be solved by designers when they understand how a user thinks, as the problem stems from the gulf between the user's mental model of how the system should work and how the interface actually does (Heim, 2007: 45). More simply, what they expect will happen when they execute an interaction with the interface. The second, the Gulf of Evaluation can be overcome by making certain that the interface reflects a good conceptual model and is therefore easy to use (Norman, 1988: 51). It ensures that the Gulf of Evaluation is minimised as much as possible (Heim, 2007: 45).

This is also seen in Rogers, Sharpe and Preece's *Interaction Design*, one of the most recently published works in the sector. Rogers, et al take their definition of the conceptual model from Johnson and Henderson as 'a high-level description of how a system is organized and operates' which allows the designer to understand what they are designing (Johnson and Henderson, 2002: 26). From there, a designer creates a design concept, which is 'a set of ideas for design' (Rogers, Sharpe and Preece, 2011: 42). Cooper, Reimann and Cronin, also add a third model, the implantation model, which is the interactive system as a completed design (what is implemented) (2007: 30). They state that these three models can be very different from each other and this creates cognitive dissonance in the user, which is similar to Norman's Gulf of Execution and Gulf of Evaluation (*ibid*: 30). Cooper, Reimann and Cronin's book explains clearly that the user of an interactive system does not need to know everything about that system, they only need to learn enough to make use of it, what the authors call the mental model (*ibid:* 32). Designers must keep these separate models in mind when designing in order to make the interface the most useful for the user that it can be.

Cooper, Reimann and Cronin suggest that the way to do this is what they call Goal-oriented Design (GOD). GOD focuses on designing for the user's end goals, their expectations of what will happen when they interface with a system (*ibid:* 15). They use the Goal-directed Design framework to achieve this: research the user, model the user, define requirements, create a framework for the design, refine it, and support the design throughout the process until it is finished (*ibid:* 20). In order to undertake GOD, it is important to understand the final goal and then break that down into the tasks needed to complete that goal (Shneiderman, 1987: 9). Each task has to be designed for, while understanding the ultimate goal those tasks will allow the user to reach. How well a system does this is denoted by its level of functionality and its reliability (*ibid*: 10). Shneiderman also includes one more aspect to his three primary design goals, which are that the design must stick to schedule and budget. Once these three goals are understood, 'human factors design goals' can be implemented to decide and understand the user (*ibid:* 11).

Though these various authors have developed their own processes over the last decades, they can all be understood as aspects of each other, though sometimes with different terminology. In practical design terms, they correlate under a paradigm, a 'general

approach that has been adopted by a community of researchers and designers for carrying out their work' (Rogers, Sharpe and Preece, 2011: 55). In order to implement this paradigm, designers adopt 'a set of practices that the community has agreed upon' (*ibid:* 55). It is these set of practices which form the components of IxD and UCD.

When undertaking Interaction Design or User-centred Design there are similar principles that are understood. No matter the users who will make use of the final product, an understanding of basic users must be put in place as well. This is especially true when designing *for* users, rather than with them, as in museums. Cooper, Reimann and Cronin explain that when designing interactives for public spaces (such as museums) the designer has to cater to the beginner. However, the designer can assume that beginners are able to adapt; they do not need too much instruction, but they do need at least a basic level and it should be presented in a simple and quick way so that the user can understand it and use that understanding to use the interactive (2007: 44). Some users will, of course, be at the intermediate stage of use and have increased skills, but this is more a focus of specific design, rather than design for a wide public (as must be in museums). Shneiderman, in the 1980s, also explained levels of understanding of users, though he labelled those levels novice, knowledgeable intermittent users, and frequent users (1987: 53). These levels are perhaps more in line with digital literacy, as Shneiderman believed that frequency of use equated with a higher ability to understand interactive systems, as some DL theorists suggest. Imaz and Benyon seem to support this when they talk about how our thinking, our understanding of things, comes from past experience (2007: 1). Designers need to better understand this process, to be more digitally literate themselves, in order to design better (*ibid:* 1). Or, as Eason (1987) puts it, they are the 'primary' users who are the ones who use the technologies the most in their everyday lives, even though they may be designing for 'secondary' or occasional users.

Sutcliffe in 1988 gave a more digital literate definition of user levels: naïve, novice, skilled, and expert (in Noyes and Baber, 1999: 19). In Sutcliffe's levels, the expert would be the designer, capable of understanding how the system worked and modifying it. The average frequent computer user, or primary user, would equate better with Sutcliffe's skilled level. And the public user, perhaps encountered in museums, would be more the novice, a person who is able to use one or two devices well but

does not understand all technologies (*ibid*). Noyes and Baber also build upon Sutcliffe in their description of Hackos' 1994 work where he suggests five categories, not four. These are novice, occasional, transfer, rote and expert (*ibid*). In Hackos' definitions of categories, novice equates with naïve, occasional with novice, and expert with expert. However, 'transfer' suggests a user who can use their understanding of one technology to learn another one and rote is a user who can follow instructions given but has no deeper understanding of how the interface actually works (*ibid*). Most museum visitors would likely fall under the 'transfer' category, as the technologies encountered in the museum would not, necessarily, be those commonly found in homes or at work.

The main aims of the field of IxD then are: to design for the user, to make the design accessible to the appropriate level of users without making it too complex, to ensure the system does not interfere with the user and their work, and to satisfy the user. For UCD, the main aim is to include the user in the design process, in some way, as well.

Gould, Boies and Ukelson, American designers, suggest a simple list of principles that, if followed, they believe will 'help you create usable computer systems for people' (1997: 231). They detail these four principles for success as: early and continual focus on users, early (and continual) testing, iterations and 'integrated design' where all aspects of the design evolve together (*ibid:* 233). These four principles were created from research undertaken by Gould in the 1980s at IBM (*ibid*). For each of these four principles, they suggest a series of methods in order to fulfil them, thereby providing a detailed (and tested) account of how to make these design principles into a successful design in usability, but not, they stress, necessarily a great design (*ibid*). Though Gould, et al have had success in their designs using these principles, they do seem very broad, as is discussed below.

More specifically, we can detail the principles of design for users (or with users) as: high levels of interface visibility, consistency, obvious constraints of use, affordance (or obvious signposting), and instant feedback to the user (Rogers, et al, 2011: 26). Alternatively, but well in line, are Norman's earlier principles from the late 1980s. They are: to use prior experience and knowledge in design, to make the structure of tasks to reach a goal simple, to make things visible, to map the interface correctly, to use constraints, to design for error, and to standardise for simplicity (1988: 189-201).

Shneiderman's 'Eight Golden Rules of Interface Design' (1987) are remarkably similar, and from the same period of the early stages of the field; consistency, feedback, shortcuts for frequent users, handle errors simply, easily reverse actions, frequent and simple dialogue between interface and user so that action sequences are obvious, allow users to initiate actions if desired, and reduce memory load by making things simple. The important points are to make designs simple for the user and easy to use, the basis of both interaction and user-centred design.

Saffer, in a style more suited to current designers, suggests six of the best principles to focus on. They are: be brief in description, make it memorable, make it applicable across the entire product not just one small feature of it, be specific (and unique), differentiate the product from others, and don't create conflict in the product as you want it to work as a whole (2010: 123-124). Saffer's design principles are perhaps more useful for systems design in the business world, where competition is key, but some principles are quite applicable to museum system design, specifically to make it memorable to the visitor and specific for its intended use.

One other set of principles must be discussed, as they come from a group of designers, basing their work on Gould's earlier suggestions. Their work was brought about after attempting to use Gould's principles in their own work and discovering there were certain issues, so they have suggested a new set of very detailed principles. The authors specifically add that all principles cannot be adopted at the same time and that it depends on the designer or company adopting the principles, in what works best (Gulliksen, et al, 2003: 401). The twelve principles that they list reflect previous authors' discussed, but there are several new suggestions to take into account. Gulliksen, et al, add that user focus and active user involvement should be design principles in all modern system designs, and that another key principle should be customization to the project or organization (one solution does not work for everyone), and thirdly, that multi-disciplinary design teams should maintain a professional attitude when working together for the good of the project (*ibid*). These additions to the previous sets of principles are interesting, as they are more specific in their user focus, rather than implied, and add several key factors that are common in modern systems design, such as multi-disciplinary teams and customization. These last two are especially significant for design in museums, where curators, educators and several

other staff from various backgrounds might work together on a specific design for a specific exhibit.

Whichever principles are used in design, the point is that they are there to weigh design decisions against. Principles should be kept in mind throughout the design process as guidelines to what the designer wants the final product to be (Saffer, 2010: 126 and Benyon, Turner and Turner, 2005: 64).

With these principles in mind, the next section will deal with understanding the processes of design described by various authors. As with the principles of the fields, the processes share similarities, as well as differences. This study assumes a focus on designing for users, rather than with users, as is still common practice in design (Eason, 1992: 3).

4.4 Processes of UCD

Designing interactive systems is a multi-disciplinary field, involving several people working together with different backgrounds to engineer the system in its entirety (Noyes and Baber, 1999: xi). This multi-disciplinary approach impacts the processes of IxD and UCD, as individual designers and authors have their own set of processes based on their backgrounds and their own work in the field. The basic, central, process that is included in all UCD is to define the user group and design for them (*ibid:* 19). In UCD and IxD, there is a predominant process found in both types of design. It is a progression of four key factors: requirements-design-prototype-evaluate. Various others add a mid-process here or there within this, but this four-step approach is the basic overall process governing UCD and IxD. It is also this process that will form the outline of Chapters 6 and 7, which analyse the research collected for this project within the four steps.

4.4.1 Requirements

The first step in the design process is requirements, according to Rogers, Sharpe and Preece (2011) who discuss the most straightforward design approach in their literature. Requirements are about identifying the end user to ‘understand how people act and

react to events and how they communicate and interact with each other' (*ibid*: 11). By establishing these requirements of the user early on, the entire project can be measured back to them over the process and ensures that the user is always central to the design process (UCD). It is against these requirements that each iteration of the design process should be measured, from the design step through evaluation, as the Figure 4.2 below demonstrates. In the museum, however, this can be problematic. Multiple iterations of a design are not always possible due to funding and time constraints, and there is also the problem that the requirements phase can only tell the designer so much about their prospective visitor. Although the iterations can be measured back to the identified requirements, designers should understand that visitors will always bring their own views with them and react to exhibits in often surprising ways. In other words, the requirements can only ever identify a 'general' sort of visitor, and provision should ideally be made within the interactive to adjust to different types of visitors and allow personalisation (if only through the type of information provided, if not the entire interactive).

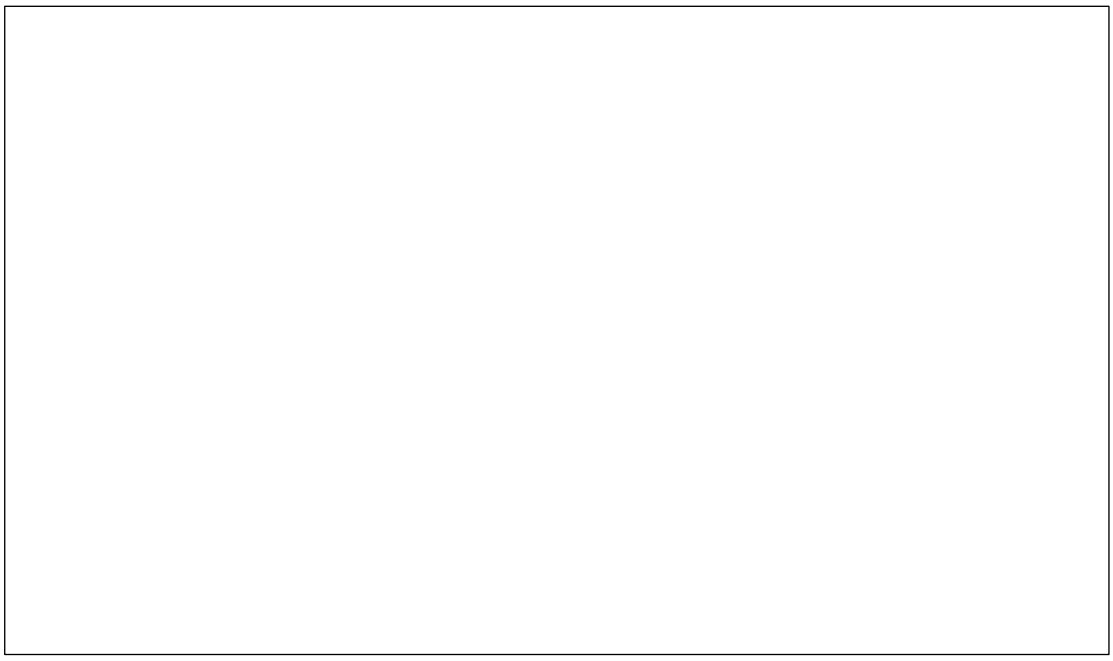

Figure 4.2: IxD Activities, Redrawn from Rogers, Sharpe and Preece, 2011: 332. Image removed due to copyright restrictions. Can be found at: http://blog.timc.idv.tw/posts/a-simple-interaction-design-model/

Other design authors, such as Crawford and Graham agree with this focus and understanding of requirements. Crawford sees requirements as a time to identify the user's goals (goal oriented design), while Graham is very focused on audience research as the first step in the requirements phase (Crawford, 2003: 94; Graham, 1999: 10).

Both of these understandings of the requirements step fit well with museum design practices, but other, competing opinions, are discussed below.

Sometimes, the requirements step in the process is also called the initiate step, usually for designers who are creating systems for a market, rather than for individual interactive projects such as museums might do. One of the founders of the Interaction Design field, Bill Verplank, suggests that the initiate phase can be further divided into two separate ways of approaching design: an attempt to correct a previous system design error or a new idea (in Cooper, Reimann and Cronin, 2007: 130-131). This is a very important step in the world of interactive design for marketed products, but is less a focus for museums, which institute interactive designs for a variety of reasons, as Chapter 7 will demonstrate. It is, however, not a unique way of looking at IxD, as Saffer (introduced at the beginning of this chapter) believes that the first step in the design is to identify the problem or opportunity that the interactive design will address, and from there research the requirements of the user (Saffer, 2010: 86).

As well as this marketing outlook on design, there is also one further way of looking at the requirements stage that is common in IxD, which is requirements of the system, rather than the user. This is divided into functional requirements (what the system can do) and non-functional (the constraints on the system) where both aspects are important for the next step in the design process (Benyon, et al, 2005: 41). Here, the user is much less obvious in the design than for Rogers, Sharpe and Preece's four-step process.

4.4.2 Design

Many authors seem to treat the design step very similarly. Some, however, focus on design in a more goal-oriented way (as discussed above), such as Cooper, Reimann and Cronin (2007: 20). This type of design process ensures that the user is always central, which can become lost in the design and prototyping phases, particularly where the requirements of the system outweigh the requirements of the user. But what is meant by the design process is conceptual design, rather than prototyping and building, which are later steps. Conceptual designs are drawn or created based on requirements, and only when the conceptual design has been finalised should the process move to prototyping. Sometimes this can involve, as Graham suggests, several different designs that can be

prototyped in a very basic way to give the end-user options (1999: 12). Saffer also agrees with this type of design, suggesting that multiple ideas are most useful and can be weighed against the original design principles agreed upon in the requirements stage, and narrowing down these ideas to one before prototyping (2010: 122 & 181).

4.4.3 Prototype

The prototyping phase is the main part of the design process, and where projects can go through multiple iterations with evaluation before a finished product is created. This is an important step; the last opportunity to ensure that the product is the best, based on the requirements of the end-user, it can be. The point of prototyping for the authors discussed here is to create a design that can be tested with evaluation by the end-user (or at least a representation of the end-user) before the interactive product goes through its final design, after which changes are more difficult to make (Benyon, Turner and Turner, 2005: 44). In some cases, only one prototype would be created, particularly for museums, and tested. However, as Abras, Maloney-Krichmar and Preece (2004) point out, the prototyping phase is often the most difficult as it is always limited in the amount of time available as well as the number of end-users that can test the product. Despite this, Crawford, Graham, Saffer and many other authors agree that prototyping is a key part of IxD and UCD, to ensure that the product created fits the requirements of the user, and is tested with the user to identify potential issues that can be resolved before the final design. As Chapters 5 through 7 will show, this particular phase of the design process is one that the museums in this study find most difficult where digital interactive design is concerned.

4.4.4 Evaluate

Last in the design process is evaluation. This is often tied into the prototyping phase where the user evaluates prototypes before corrections are made and the final design is initiated. As Rogers, Sharpe and Preece (2011) suggest, evaluation should not be a definitive last step, but part of an iterative process where evaluation of the product identifies issues and the design then returns to a previous phase to create solutions to those issues, repeated again and again until the end product is, ideally, the best it can

be.[25] Evaluation therefore becomes a step within the process as well as the final step before the process is considered complete. Benyon, Turner and Turner have a similar approach to evaluation, but for these designers, evaluation is more central to the entire process and each stage has its own level of evaluation (from requirements through prototyping and final build) (2005: 45). Not all authors put the same emphasis on evaluation as those just mentioned. Some believe that evaluation is conducted at the same time as prototyping, but not during any other step in the process (Abras, Maloney-Krichmar and Preece, 2004).

The designers and authors discussed in this section have their own processes, based on their own experiences, but despite this there are similarities across these ever changing fields of UCD and IxD. The important key stages are to set requirements when identifying the end user, create a design based on these requirements, prototype and test the design and evaluate against the requirements, and then to begin again as necessary to ensure the finished interactive design will work in the best way possible. These stages are present in museum interactive design in their most basic formats, as the analysis chapters will show.

4.5 Research Using UCD in Museums

UCD is particularly relevant to museums. There are several academics working in the study of interactive design, in its various forms, within a museum context. Several of these academics are introduced below; they are investigating new ways to understand the visitor (the user) and to design products that work towards their enjoyment and learning in and outside of museums.[26]

A basic framework or set of rules is needed in museums for exhibition design as a whole, not just the design of interactives. For instance, there is little agreement in the museum about what 'interactivity' actually entails. It can refer to solely digital technology or anything physical that the visitor interacts with, according to Australian

[25] Factors such as cost and time also practically effect this process, as shown in the museums in the case study.

[26] These authors are introduced only as examples of research being done in UCD and museums, and how it manifests itself in practice. It is by no means an exhaustive list of researchers working in the field.

professor Roppola (2012: 44). As Hein pointed out in 1998, 'hands-on' does not mean brains are turned on (31). It is possible to make a physical interactive that is not remotely educational, at least in teaching the visitor about a concept through motion (Roppola, 2012: 218). Even though there is evidence that interactive exhibits in museums do not support conceptual links, they are still very popular (*ibid:* 257). We are in 'an era that expects museums to be responsive to audience needs' and exhibition design plays a key part of that (Bedno, 1991: 53). Twenty years on, this is still true, Roppola suggests (2012: 8). More understanding of the visitor, how they use digital technology in the museum, is needed in order to design for them. With this, however, is also a move towards using user-centred design as a more focused and ingrained method in interactive creation. Though there are multiple versions of UCD, as we have seen, the basic premise lies around focusing on the end user, involving some sort of iterative process of development and generally begins with identifying user requirements (rather than system ones). However, rarely has this entire process been implemented; it generally starts with user requirements, but the theories of UCD are lost somewhere during the further design (Petrelli and Not, 2005).

At present, the focus in museums has often been on mobile designs for audiences, part of the current trend for app creation and websites, amongst other new formats (American Alliance of Museums, 2013). Therefore, many of the UCD research studies are concentrating on this form of design, and specifically how mobile can be used to increase engagement and learning with museum collections, rather than detracting from them.

Researchers Giasemi Vavoula and Mike Sharples offer insights through their research on mobile learning design. They document how difficult it is to measure the outcome of mobile learning (and therefore mobile use of systems in museums) (Vavoula and Sharples, 2008). This is a complex problem faced by any type of digital design in the institution, as learning need not be cognitive facts, but is rather personal and individual. In response to this issue, how to design and measure mobile learning in museum institutions, Vavoula and Sharples suggest a specific format of UCD. This is a four-phase process, beginning with requirements, then design, implementation and finally deployment to the public (*ibid*: 5). Evaluation, both formative and summative exists

within this process, allowing the developers to measure the differences between user expectation and reality (the actual user experience).

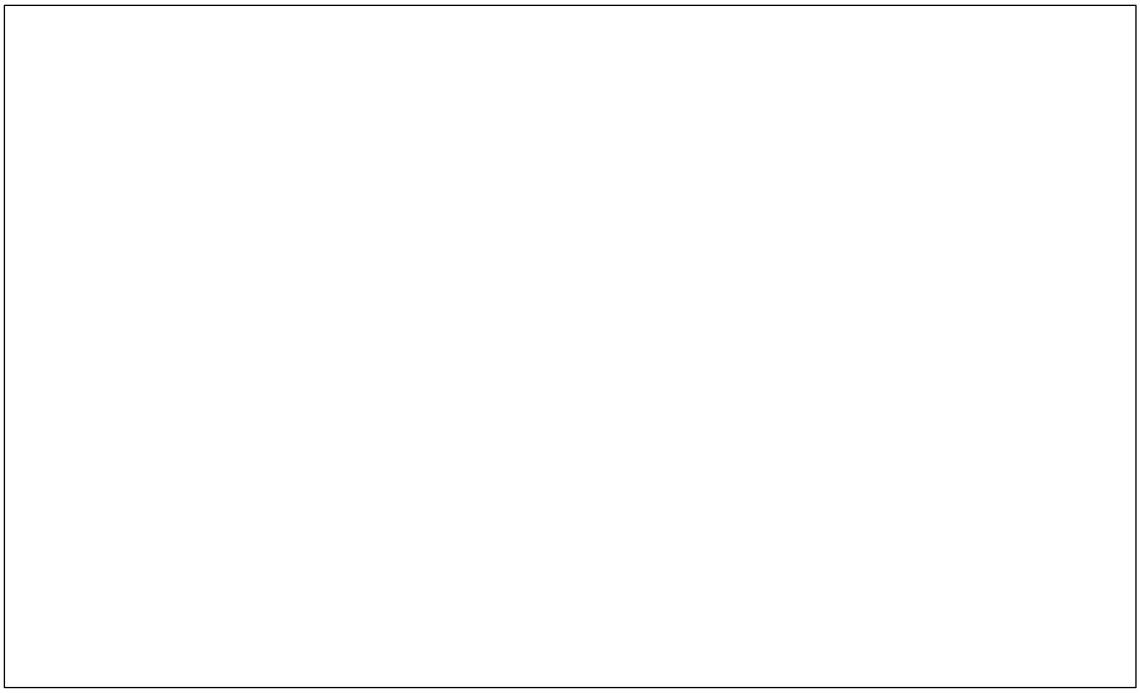

Figure 4.3: Evaluation as central to the design process over phases 2-4. Taken from Vavoula and Sharples, 2005: 5. Image removed due to copyright restrictions. Can be found at: https://www2.le.ac.uk/Members/gv18/downloads/publicationpreprints/conference-proceedings/VavoulaSharples-mlearn2008.pdf

Vavoula and Sharples suggest a type of Lifecycle approach where evaluation is part of the entire design process, existing in the centre of the diagram, as Benyon, Turner and Turner (2005) also propound. Evaluation must be completed on a larger scale, throughout the design (see Figure 4.3) by evaluating the usability of the technology, the learning experience with the technology and the long-term learning impacts (Vavoula and Sharples, 2008). Evaluation in Vavoula and Sharples' project is also undertaken at various levels, from micro through macro, depending on the point in the process: all levels of evaluation take place at the end, while only micro, for example, is undertaken in phase two of the design (*ibid*: 5). This ensures an overall evaluation that does not miss key everyday learning aspects of the mobile technology, unlike traditional forms of evaluation. With evaluation as the centre of the process, it allows for continuous iterations of the design, with the focus on understanding and adapting for the user audience (Vavoula and Karagiannidis, 2005).

Vavoula has also carried out research into designing with children for mobile systems, using the Future Technology Workshop concept, a process that uses multiple workshop sessions with children to incorporate human-computer interaction practices to make activities and technology work together. The focus of these workshops is specifically on designing for the future with children, not just for the present and to drive design into new ideas and formats (Vavoula, Sharples, Cross and Baber, 2003). This sort of intense designing, with users, was discussed in Chapter 2, but is still a new concept in exhibit and mobile design for museums.

Amongst the more mobile aspects of design, Yang's research into virtual systems in museums has looked at how UCD can be useful in developing a fully virtual online experience that is attractive ascetically to the visitor and supports their interests (2009). However, Yang is clear in the difficulty presented with attempting to cater to all user preferences (interests). In order to ensure the virtual interface designs are successful for the user, designers need to 'understand how users think and work' (*ibid*: 1648). To do so involves understanding both internal and external factors. Internal being those Yang describes as user familiarity with the system, their user technique, their knowledge and their user habits. External factors that must be understood deal with the system and its 'content, context, and feedback presented by the interface as it is used' (*ibid*). The internal factors dictate how the user will see and use the interface, while the external issues relate to how the interface is actually designed. This is very similar to identifying user requirements and then designing for them, though Yang views this as less a step process and more factors that play out throughout a virtual interface design. Yang believes that the most important aspect to a successful design is have a clear user conceptual model (the internal factors) and designing an ascetic system (external factors) to work with that model (*ibid*: 1650).

A similar type of design to virtual museum interfaces is that of creating entirely interactive experiences, or virtual reality installations. They can be useful ways to engage the public, particularly when there are no actual collections or site accessible to view, such as with the Vrouw Maria ship in Finland, which is a still submerged wreck and therefore not open to the public. Instead, designers attempted to create an immersive installation on shore to showcase the shipwreck and marine archaeology topics. The design used UCD methods, particularly calling on Royce's waterfall model

(system requirements, software requirements, analysis, design, coding, testing and deployment) while also employing Rogers, Sharpe, and Preece's iterative methodology (Reunanen, Díaz, and Horttana, 2015: 4). The immersive installation was created with a concept development team who identified three different types of users (foreigners, marine enthusiasts, and school groups) and developed a storyboard narrative for these users. From there, an interaction matrix of each step the user would go through with the installation was created and a prototype was developed to be user tested before the final launch. Several issues were found during this final evaluation phase, and the process was returned to the previous steps of design until the issues had been addressed (*ibid*: 10-11).

A more online enabled example of UCD in museums is that of the project created to provide public access to the Rijksmuseum's collection. The project was begun when it was realised there was a disconnect between how users accessed the online collection and how the experts created it to be accessed (Wang, 2007). The project worked to collect end user data to better develop collection access, by collecting data from users on how they rated and recommended particular artefacts, slowly building up a gradual profile of the visitors likes and dislikes towards a user model (*ibid*). By analysing the results the users gave, the system could be developed to refine the user's preferences over time. To do this project, designers and researchers used the UCD lifecycle approach, where a prototype was created to be tested based on earlier feedback and evaluation of the original collections access; the prototyped was field tested and evaluated before the collections access was revised (*ibid*).

As Darling, et al state, user needs are often ignored when designing interactives and mobile applications. However, the Center for Interdisciplinary Science for Art, Architecture, and Archaeology created a unique augmented reality system called ARtifact to make their collections more available to the public (Darling, et al, 2013). The centre undertook interviews to refine the design of their system with actual users, undertaking the evaluations at several cultural locations where the mobile app would be used and focusing on how the user actually made use of the app (their behaviour with it). The researchers discovered that visitors preferred freedom in how they explored the app during their visit, allowing them to follow different interests. In light of this, ARtifact was redeveloped to allow this freedom of use and make its features clearer to

the visitors using it, thereby enabling their exploration of the centre's collections (*ibid*).

As we can see, there are many different variations of using UCD when designing digital systems. Some projects have used set methods of design discussed in this chapter, while others have created their own set of principles to follow. For the purposes of this study, the theories, practices and principles behind IxD and UCD were used for the analysis of the data collected during field research at three museums in England, to uncover where in the design process museums are making their assumptions. The theory can only be limited, as museums do not, at least in many cases, design using set practices of IxD and UCD and this study does not set out to understand museum design along these lines. Citing Roppola above, it is clear that more research needs to be conducted in this field outside of this individual research project. The main aim of this project, however, is to understand assumptions of museums in their design practices and what those practices are and have been over the last fifteen years.

4.6 The Four-Step Model of Design in Use

The fields centring on designing for users are complex. As Saffer calls it, they are a 'stew' (2010: 20). However, certain disciplines within the larger field are used for certain types of design, and an understanding of all aspects is not necessary in order to understand one part. This chapter has focused specifically on Interaction Design and User-centred Design; these are the two disciplines most useful for museums when designing digital interactives.

This chapter explained the basic terminology within the wider field of study. Only a small lexicon is needed to understand how IxD and UCD impact this particular project and those terms have been covered here. The definition of IxD as 'designing interactive products to support the way people communicate and interact in their everyday and working lives' specifies a focus on supporting users, as museum interactives should do (Rogers, Sharpe and Preece, 2011: 9).

For UCD, Eason's levels of involvement by the user are the most influential. They are design for users, design by users and local design by individual users (Eason, 1992: 3). For this study, 'design for users' is the most significant, as it is the main form of design

found in museums, where staff design interactives for their visitors without involving the visitor directly in the design process. Despite this lower level of involvement (non-participatory design is perhaps a good term), the user (or visitor) is still the central focus upon which the design hinges. Designers still understand that there is a visitor audience who will use the interactives and they are the ones they must design for. This is a central issue in this research project, which seeks to discover what assumptions about visitors museums are making, within interactive design.

Rogers, Sharpe and Preece offer a suitable process for interaction design that could be implemented in museums. The simple four-step process begins with establishing requirements, then the conceptual design, followed by prototyping, and evaluation (2011: 330). Rogers, et al (2011) suggest that evaluation is the key and each design must be evaluated against the requirements established with the users in mind. They suggest an iterative process, where the design goes through multiple versions to achieve the best result. However, it is understood that such a time consuming form of design would be costly for museums in both resources and expenses and would therefore be difficult for such institutions to implement in its entirety. However, the basic four-step design is a sound version for museums to employ, and the case study institutions in this project all achieve a certain level of this process. As such, the four-step design process will form our understanding of the three museums in their design of digital interactives, and structure Chapters 6 and 7.

To uncover what assumptions our three case study museums (the NSC, the Herbert and WPM) have made in their designs over the last fifteen years, it is proposed here that it would be productive to look within the design processes of each institution. Missed steps and a lack of design principles would suggest assumptions had been made over the use of visitor research. This type of data can be found within the design briefs that the museums have provided for specific galleries and interactives, and more so within the transcripts of interviews with staff who have been involved with the designs. Transcripts and design briefs provided information on designing digital interactives and permitted detection of differences in how the museums design different types of interactive exhibits for different audiences.

Combined with the digital literacy theory discussed in the previous chapter, user-

centred design forms part of the three contrasting approaches at the centre of this research. That is, digital literacy, user-centred design and museum studies. From this chapter, we now have the key terminology and the main processes of UCD to help uncover the discourses on digital literacy (discussed in Chapter 3) within the interactive designs of museums for children.

Chapter 5: Case Studies

5.0 Introduction

The previous chapter on user-centred design outlined the process of digital interactive creation, both in general, and within museums. This chapter, using those theoretical ideas, looks into the case study museums to understand their process of digital production. As previously stated, this data was mainly collected through interviews with staff, and documentation held by museums such as design briefs, images and observation. Chapter 5 examines this data in light of our understanding of the literature, linking the casework with user-centred design specifically through the exploration of interactivity in the museum and the four-step design process.

This chapter will explore the approaches to the process of digital interactive design used within each of the case study museums. Specifically, this chapter aims to introduce and provide an overview of each museum, and how they have designed digitally over the last fifteen years. The three museums in this study are intended to serve as an illustrative example of not only institutions with varying founding principles and purposes, but also a representative range of expertise around digital media and design. There are a variety of ways that museums have developed the design of their exhibitions, however the three examples described below with the case study institutions are inclusive of several of these varieties.

The chapter will introduce the three institutions and then explore the concept of how interactivity can be measured within them. The chapter will then overview how the National Space Centre (NSC), the Herbert Art Gallery and Museum (Herbert), and Weston Park Museum (WPM) have appropriated digital technology for use within their galleries. Lastly, through the four-step design process (introduced in Chapter 4) this chapter will delve further into exploring design in the case study museums. It will serve to introduce the structure that will be used to arrange the arguments in Chapters 6 and 7 with requirements, design, prototyping and evaluation as stages of the design process where assumptions are made.

5.1 Introduction to the Case Study Museums

Understanding the founding and continued history of the case study museums is important to this research. Much of their development, focus and staff compilation directly affects their view of their visitors and therefore the assumptions they make regarding those visitors. Subject matter of the institution can play a key role in this, but the remit of the institutions and what segment of the audience they put foremost is of particular importance. It is through these methods that the centres have created their digital interactives. The following section gives a brief history of each institution, before moving on to discuss the case study museums in terms of their digital interactivity.

5.1.1 The Herbert Art Gallery and Museum

The Herbert began as a civic museum thanks to a large grant by local industrialist Sir Alfred Herbert in 1939 (Anonymous, Online). It build upon the work local archaeologist John Bailey Shelton had conducted in the same decade, unearthing over 2,000 objects in the area with no place to house them. However, the Second World War put a stop to construction and the museum did not open its doors until 1960 (*ibid*). Until the 1990s, the museum mostly contained art galleries, until Godiva City Gallery, billed as a history gallery, opened in 1994 (Roberts, pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013). Prior to the redevelopment, there were few resources to allow staff to design with digital, except for sound editing for oral history exhibits (*ibid*). This was part of a desire to focus on Coventry social history to attract local visitors and display the collections the museum had held. However, a regime change in 1999 at the city level saw a desire to do more and redevelop the centre to benefit the community, but to also bring in tourists (*ibid*). The planning began in 2002 for gallery redevelopment, including a large extension to the existing building that allowed for eight new galleries, including art and history and temporary exhibition space. The History Centre, an area dedicated to the study of local history, also became part of the new Herbert Art Gallery and Museum, which opened its doors in 2008 (Keston, n.d.). Less than two years after reopening in 2008, however, the new centre won the Guardian Family Friendly Museum Award in 2010 for its provision for children and their parents in galleries and programmes (Culture24, 2010). The Herbert is now a central piece of

Coventry, serving the local community through family visits and school groups and showcasing local history, nature, art, archaeology, and industry.

The redevelopment was undertaken through an outsourced company, but with the briefs for the designers written by curatorial staff at the museum, who also continued to be involved in the on going design process over the five years it took to open the new building. Using existing staff knowledge of the subject of the museum and the visitor was key, while the outsourcing relied on proven knowledge of a design company to handle details such as digital interactives and graphics that the museum staff were not able to do themselves (Roberts, pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013). Since 2008, the museum's own design department, Herbert Media, has come to stand in for much of the design expertise and staff at the museum have been more able to handle projects internally with a range of experience.

5.1.2 Weston Park Museum

Weston Park Museum (WPM) in Sheffield is an example of a significantly older city museum. Opened in the second half of the 19th century and then called Sheffield's City Museum and Mappin Art Gallery, the centre was a depository for local archaeological and industrial objects. By the late 20th century, the galleries had become images of a by-gone era, and were in need of redevelopment, adding to structural issues of the building itself located on the western edge of the city centre (Streets, 2006). The visitor demographic to the old museum was mostly families and school groups and this became the set focus of the new centre, on which work began in the spring of 2003. The work was funded through a large Heritage Lottery Fund grant. During the redevelopment, the museum remained closed to allow for construction work. 'The ambition', Kim Streets of the museum wrote, 'was to offer interactive and multi-layered displays that would provide access to different amounts of information depending on the visitor's own needs (*ibid*). It was a place for visitors to discover, create, explore, and enjoy (*ibid*). Social history formed a large part of the collections, and an entire gallery was devoted to the subject in the new centre, along with art galleries, natural history galleries, exhibition space and educational spaces. The new museum reopened in 2006 to the public and won the Guardian Family Friendly Award in 2008, placing it in a similar position to the new Herbert. However, drastic changes followed this success,

resulting in massive staff cuts and further reduction in expenditure, which has made any further development at the centre nearly impossible (Culture24, 2010b).

The original gallery designs had been headed by an outsourced design company, relying on its own years of experience to develop the gallery spaces to best meet the needs of the National Curriculum. There are several key areas where museum staff were more obviously involved, including the later design of the *Treasures* gallery, but the *What on Earth!* natural history gallery referred to in this thesis was spearheaded by an outside company (McLean, pers. comm. 17 September 2013). It is only since 2012 that WPM and Museums Sheffield as a whole have taken on more gallery developments themselves, though not on the large scale of the 2006 redevelopment.

5.1.3 National Space Centre

Unlike the Herbert and Weston Park Museum, the National Space Centre (NSC) in north Leicester developed out of a UK-wide need for a space museum. The Centre was part of the 1990s Millennium Projects, funded by the UK National Lottery (Hauser, 2006). The building was designed and constructed in an already existing site, making the Centre a representation of museum exhibition at the end of the 20th century. It opened to the public in June 2001 to be 'a beacon of education and research' for the public and the University of Leicester (*ibid*). The Centre included five permanent galleries dedicated to a combination of space history, objects and space news, as well as a large planetarium. Part of the Centre also included the Challenger Learning Centre for school groups allowing for educational simulations of space missions. The Centre was linked to the National Curriculum at the time, intending that education be one of the core elements of the Centre (University of Leicester, 2001). However, in its first years after opening, only a quarter of visitors were school groups, with the rest being mainly families with children, and staff do feel that the Centre is more of a visitor attraction then an educational facility (Bishop, 2006; Shorrock, pers. comm. 11 February 2013).

The National Space Centre provides a contrast to the more traditional museums like the Herbert and Weston Park, and therefore helps to offset the challenge of making assumptions about all museums based on only tradition social history examples. Despite the varying backgrounds of these three institutions, as well as their focus,

audience and evolving remit, there are stark similarities that do suggest there can perhaps be generalisations made regarding other English museums.

As the Centre was created prior to the hiring of many of the staff, a local company, Haley Sharpe Design who had a proven track record of large-scale projects, designed the NSC. Since the Centre has opened, the internal design company, NSC Creative, has taken over the role in digital design and more recently have become part of the exhibition team (Mowbray, pers. comm. 26 February 2013).

5.2 Cultures of Interactivity

Since the inclusion of digital technology, these institutions have used digital interactivity to varying degrees. Although each museum has included digital in its galleries in similar ways, the levels of digital and the amount of focus placed on it has been different between the institutions, as we will see in Chapters 6 and 7.

Parry and Sawyer created a method of examining the levels of integration of ICT into museums in six phases, relating to periods of adoption beginning in the 1950s (2005: 46). The phases begin with ICT sitting outside the museum, and move into recent ICT adoption, which is 'innate' (*ibid*: 47). Parry and Sawyer's phases provide a useful way of looking at ICT integration in the case study museums, to understand how ICT has been adopted, used and how each museum relates to the others in where they are in ICT adoption (see Figure 5.1 for all six levels of integration).

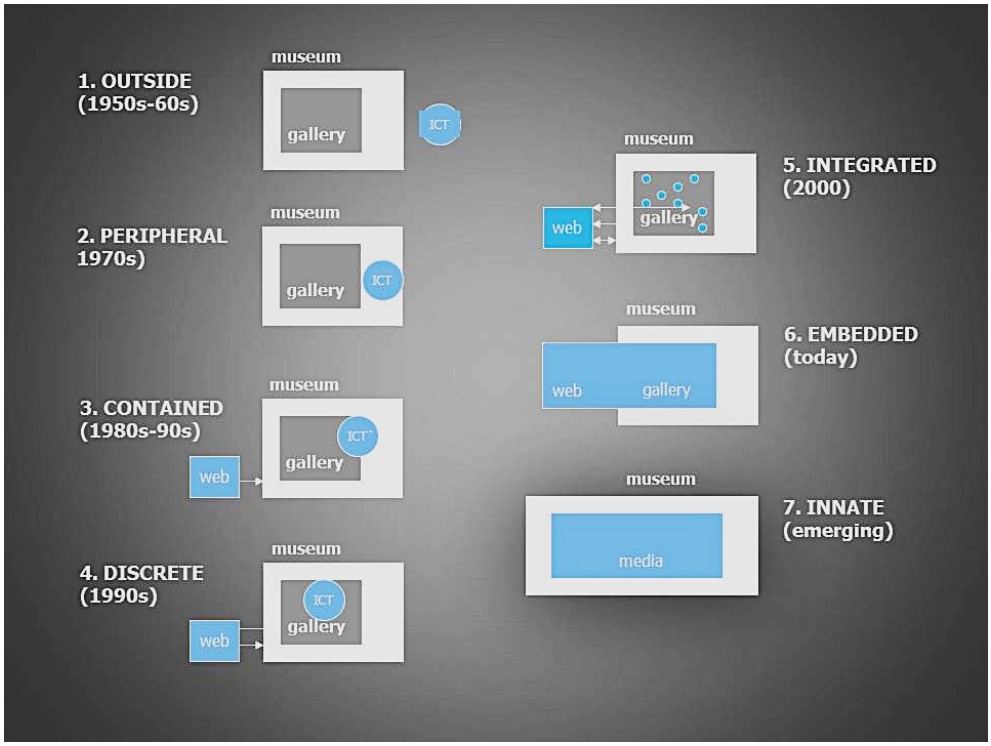

Figure 5.1: Levels of ICT integration; source: Ross Parry, developed from a concept that first appeared in Parry and Sawyer, 2005: 45. Reproduced with permission.

In the 1950s, ICT had not yet entered into the museum, as this was the era before computers developed for public consumption. It was not until the 1970s, when the first computers became available for personal use that ICT entered into the museum, but it was not widespread and was contained, according to Parry and Sawyer, to the administrative areas of the museum, rather than the gallery (*ibid*: 46). In the 1980s and through the 1990s, however, ICT began to make its way into the gallery spaces, with devices like information kiosks, but these remained separated from the main galleries. It was the change to stage four, the 'discrete' phase in the 1990s, where ICT became more obvious and found within main gallery spaces (*ibid*: 46). The web also appeared at this time, as something outside the museum, but began to permeate inside the gallery space in the fourth phase. In the fifth phase, the 'integrated' ICT of recent years, museums can be seen to have integrated ICT into the galleries and to exhibits, and where the web has enabled a connection between on-site visits and off-site (*ibid*: 46). The finale phase, which Parry and Sawyer believe was emerging in the mid-2000s, and which can be seen in the designs of galleries discussed in this research, is 'innate' ICT. This is where ICT is 'integrated so deeply into the practices of curators and designers, harmonized so thoughtfully and appropriately into the interpretive strategy of the exhibit […] that it

becomes an integral and ambient component of the exhibition' (*ibid*: 46). However, this finale phase was one Parry and Sawyer saw as emerging in 2005, and a decade later it is a phase that is not only common in many institutions (such as the case studies in this research), but more research into current practices in galleries might even suggest that we are moving from phase six towards a new form of ICT in museums. As such, this finale phase, though suggested as where museums should be during the period in which this research project took place, might already be out of date from what Parry and Sawyer envisioned. However, in the general terms in which the ICT integration is viewed below, particularly with the historical look at the case study museums, it is felt that the six phases still constitute a valid way of understanding how museums have adopted and used technology.

The NSC has the most number of digital interactives in-gallery of the three case studies, though digital media is not included in every aspect of each of the galleries. The galleries that are arranged as a traditional display of objects are static, with text panels and display objects behind glass, just as at the Herbert and WPM. However, there are more interactive galleries, such as *Space Now* and *Tranquillity Base* that combine physical and digital interactivity into exhibits.[27] The NSC therefore is an example of both 'integrated' ICT, in those galleries where digital is predominant, but also 'contained', in the fact that there are galleries that are static, and ones that are digitally interactive. The newest gallery, the 'Sun, Earth, and Moon' exhibit, discussed as part of this research, begins to integrate ICT in a way that is more advanced than simply integration and appears more 'innate' in its design.

This is also the case at the Herbert, where its redeveloped galleries share levels of interactivity to appeal to a wide audience. As with WPM, digital interactivity is something placed in specific areas of the gallery space, rather than as something used to form an entire exhibition, thereby providing an example both of the 'contained' phase of ICT adoption, but also the 'discrete' phase where ICT is found in stand-alone stations. However, all of the galleries have some type of interactivity in them, though at WPM the *What on Earth!* gallery and the sub-gallery *History Lab* are by far the most

[27] *Tranquility Base* is an interactive experience for visitors added after the NSC opened, while *Space Now* was an original gallery completely overhauled in 2007 based on public consultation and evaluation.

digitally interactive,[28] contrasting with the *Arctic World*[29] exhibit that was designed to be physically interactive.

At the Herbert, the *Elements*[30] gallery is subsumed with both digital and physical interactives, owing to its brief as a space that transcends disability and accessibility (Gallery Critique of the Herbert, 2013). *Elements* is a good example of Parry and Sawyer's 'innate' ICT, where the technical is 'conceived as another quality of the gallery' and becomes integrated to the extent that it is hidden (2005: 46-48). Therefore, all three institutions display varying use of interactivity, where some of them rely more on physical and others on digital, though this changes across exhibitions and across time. As well, all three of the institutions have a developed web presence which is available for visitors to explore before and after their visit, tying their on-site visit to the online experience; thus displaying an 'integrated' approach to ICT. The websites provide visitors information about the museums, specifically their collections, to allow the visitor to plan their visit in advance, and understand what galleries and objects might be of particular interest when visiting on site. After the visit, the websites also provide children's activities (many of which can also be used during the visit), further information for exhibitions, as well as suggestions on upcoming events for children and families (for repeat visits). This ability to provide the visitor with information before, during, and after the visit integrates ICT within the physical and online aspects of the institutions.

[28] *What on Earth!* is to be found in the back of Weston Park Museum and details natural history as a subject matter, while History Lab is a sub-section of Sheffield Life and Times (social history) gallery allowing visitors to explore Sheffield's past through personal stories.
[29] *Arctic Worlds*, which will be discussed in more detail in later chapters, was designed for a young visitor audience to explore the Earth's polar regions, through hands on physical activities.
[30] *Elements* explores that natural world (natural history) through various creatures and their habitats.

Figure 5.2: *History Gallery* interactives. Image copyright of Herbert Art Gallery and Museum, reproduced with permission of Martin Roberts, Senior Curator.

The Herbert is characterised by computer systems, both touchscreen and keyboard or mouse operated (such as in Figure 5.2). As well, oral history stations dominate the galleries, as the oral history archives are an important aspect of the museum. These usually appear at stations that use button technology to select from a range of audio recordings. Touchscreens are found in *Discover Godiva*[31] and the *History* galleries, though they are used in ways similar to traditional computers: to look up information or answer quiz questions.

[31] *Discover Godiva* is the Herbert's children's discovery gallery, based on the history of Lady Godiva and her place in Coventry's history, including many hands on and digital activities.

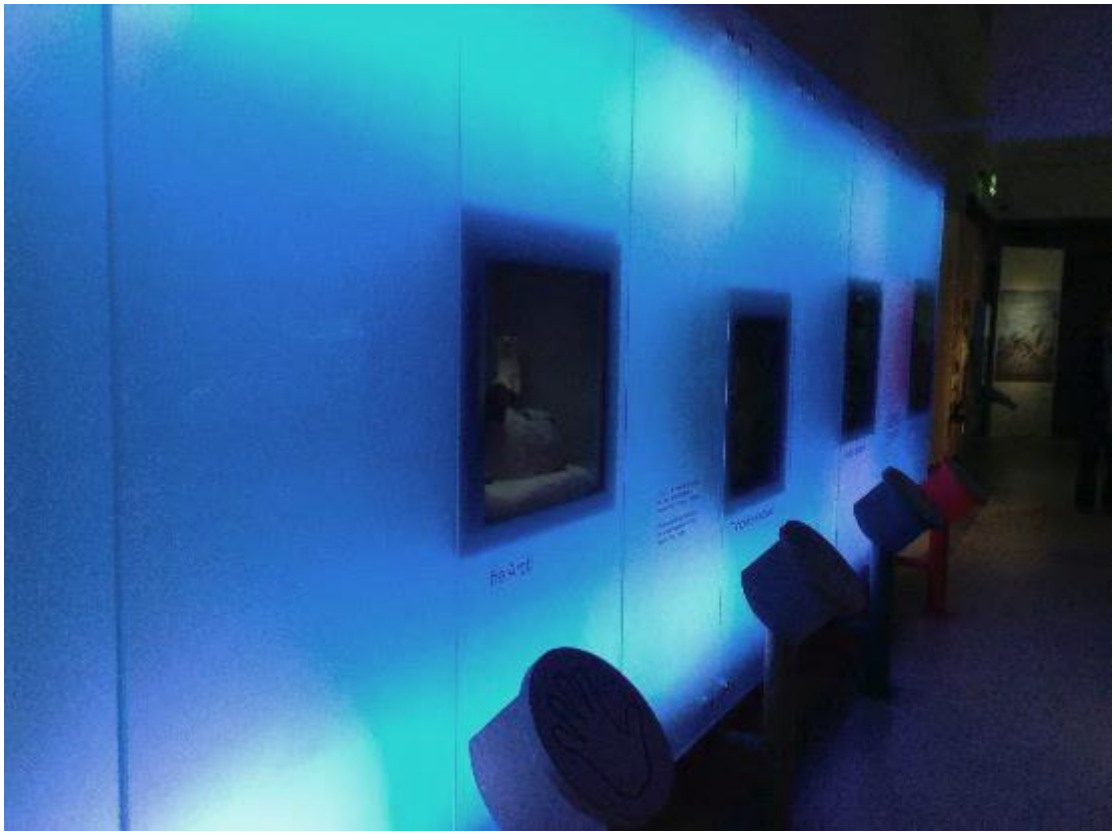

Figure 5.3: *Elements Gallery*, the Herbert – interactive habitat wall. Image by author, used with permission of the Herbert Art Gallery and Museum.

A complex and bespoke form of interactivity appears in the *Elements* gallery particularly (Figure 5.3 demonstrates the unique interactivity), as it is a bespoke design, showcasing animals and habitats around the world through sound, sight, touch and sensation. Weston Park shares a similar level of interactivity, as it is dominated by computer systems (touchscreen and keyboard operated), and also contains oral history stations, as the Herbert does. Bespoke designs particular to a certain exhibit are not common, and one of the most innovative interactives in the space has never worked[32], according to WPM's natural history curator (McLean, pers. comm. 17 September 2013).

The case at the National Space Centre is different. Partly this can be attributed to the subject matter at hand; Adams and Moussouri's work has suggested that 'science centres are by their very nature and original mission interactive' as science and space lend themselves quite well to bespoke digital designs (2002: 6). Traditional computers

[32] This is the *Push the Poo* interactive in *What on Earth*!'s area about forces of nature where visitors were intended to be able to test their strength against that of an ant.

are less obvious in the original galleries and what is there is operated through a touchscreen in a game-like or quiz-like interface. Over the last decade, bespoke designs have been common in the newer areas of the Centre, from the *Rocket Tower* through *Space Now* to the new 'Sun, Earth and Moon' section of *Looking Up*.[33] There is a firm drive by the design staff to create systems that are not quite the same as those visitors would have at home, to make them different but still accessible (Howell, pers. comm. 13 February 2013).

In all three museum examples, the level of digital interactivity has been shaped by the subject matter of their respective galleries, but also in part by the resources (both time and funding) available to each institution. Joe Cutting, previously of the Science Museum in London, has provided for museums' use a cost breakdown explaining the resources required to create a digital interactive.[34] The highly prohibitive cost of interactives has meant that the case study museums have struggled to design digitally, particularly without large funding sources (Travis, pers. comm. 8 April 2013; Roberts pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013). As such, digital interactives at the Herbert and Weston Park exist mainly because of their centres' redevelopments that allowed for large budgets and outsourced design companies. The NSC has been slightly different. Though its original galleries owe also to an external design company (Haley Sharpe Design[35]) and a large budget, newer galleries have been created around bespoke digital designs by the Centre's own staff. Surveying the use of digital in the galleries in these museums for this research, from both interviews and documentation, we can see that there has been a determination to include digital from each institution, but at various levels of ability.

We now turn to the case study museums. This chapter has already introduced their history and briefly outlined their development. However, understanding their design processes over the years, the staff who have been involved, and how digital interactives were created will set up Chapters 6 and 7. These case study museums are unique in their histories and design process, owing to their individual staff, the subject matter, and

[33] The Rocket Tower is the annex of the NSC that contains three levels of gallery space around a central 'rocket' and was originally the area that contained satellite and space debris models. Looking Up allowed visitors to explore the planets, moon and star of our solar system, with the Sun, Earth and Moon section at the beginning of the gallery.
[34] Found on his website: www.joecutting.com/beginnersGuide.php
[35] A Leicester based company; Haley Sharpe Design created the interactives (physical and digital) as well as designed the exhibitions for the NSC's 2001 opening.

their integration of ICT. All of these have had an impact on how digital interactives in the galleries were designed (as the next sections will demonstrate), and this has, in turn, impacted the museums' understanding of digital literacy.

5.3 National Space Centre

The National Space Centre was opened in 2001 and its design was markedly different from the other, more traditional, museum redevelopments of WPM and the Herbert. The Centre had no prior audience on which to draw evaluation studies for user-centred design purposes, and no visitors to seek opinions from during prototyping phases of development. Most of the staff at the National Space Centre that are currently employed or were employed after opening were brought on after the development work had finished, most beginning only just before or after the Centre opened to the public in 2001 (Yates, pers. comm. 31 January 2013). There was no curatorial or learning team in place to be involved in the development, therefore the creation of the Centre relied on the past experience of the design company, Haley Sharpe Design, which has a wealth of prior experience, as seen on their website in Figure 5.4.[36] With education as a core element of all the galleries, the idea of the end-user (the visitor) has therefore played a part in the design, but less directly, perhaps, than at Weston Park Museum, which had continuous public consultation during its redevelopment (from staff Interviews at WPM in 2013; for the NSC's educational remit see Yates, pers. comm. 31 January 2013).

[36] Haley Sharpe Design projects: http://www.haleysharpe.com/category/projects/

Figure 5.4: Screenshot of Haley Sharpe Design's Projects page on website http://www.haleysharpe.com/category/projects/ Image removed due to copyright restrictions.

The NSC, though it does contain a collection of artefacts[37] that are displayed, appears as a science centre, more than a museum (Law, pers. comm. 13 February 2013). It explores concepts and themes more so than historical objects, and is also very focused on current and future aspects of the space programme. The NSC requires that it exists off its own funding ability from a variety of sponsorship and funding streams in order to continue its operations (from Yates, pers. comm. 31 January 2013; Mowbray, pers. comm. 26 February 2013). As such, development since the Centre opened has relied mainly on staff expertise, as at the Herbert, and visitor feedback of existing galleries in order to improve, including the 2006 and 2008 reports regarding Space Now, by the University of Leicester (Parry and Crusciel, 2006 & 2008; from staff interviews at the NSC in 2013).

The NSC's approach to digital production over its first fourteen years has undergone a significant change. In the late 1990s, the NSC underwent its development by Haley Sharpe Design. Since its opening in 2001, however, the Centre has undertaken its own gallery designs. The Head of NSC Creative, attributed one reason for approaching subsequent designs internally, mainly the quality of the service from external companies: 'there have been a few instances where we've used external people and we've not been happy with what we've received so we've taken on ownership of making it internal' (Mowbray, pers. comm. 26 February 2013). NSC Creative was originally the production department for the Centre, and existed to produce planetarium shows for the new NSC after 2001(as Figure 5.5 demonstrates). The Head of NSC Creative reports that since 2008[38] it has become its own company, focused on producing digital products for cultural and other organisations around the world (Mowbray, pers. comm. 26 February 2013). In a sense, NSC Creative is now a company that carries out design for other institutions, while existing also to serve as

[37] Artefacts can be found in most of the Centre's galleries, observed during gallery critiques and observation during data collection for this project – objects range from models of space mechanics to spacesuits, geological specimens and pieces or rockets.
[38] 2009 saw the launch of a wide variety of projects for NSC Creative, detailed on their website: http://nsccreative.com/ourwork/

available skills for the NSC's gallery redevelopments (beginning with the *Rocket Tower*).

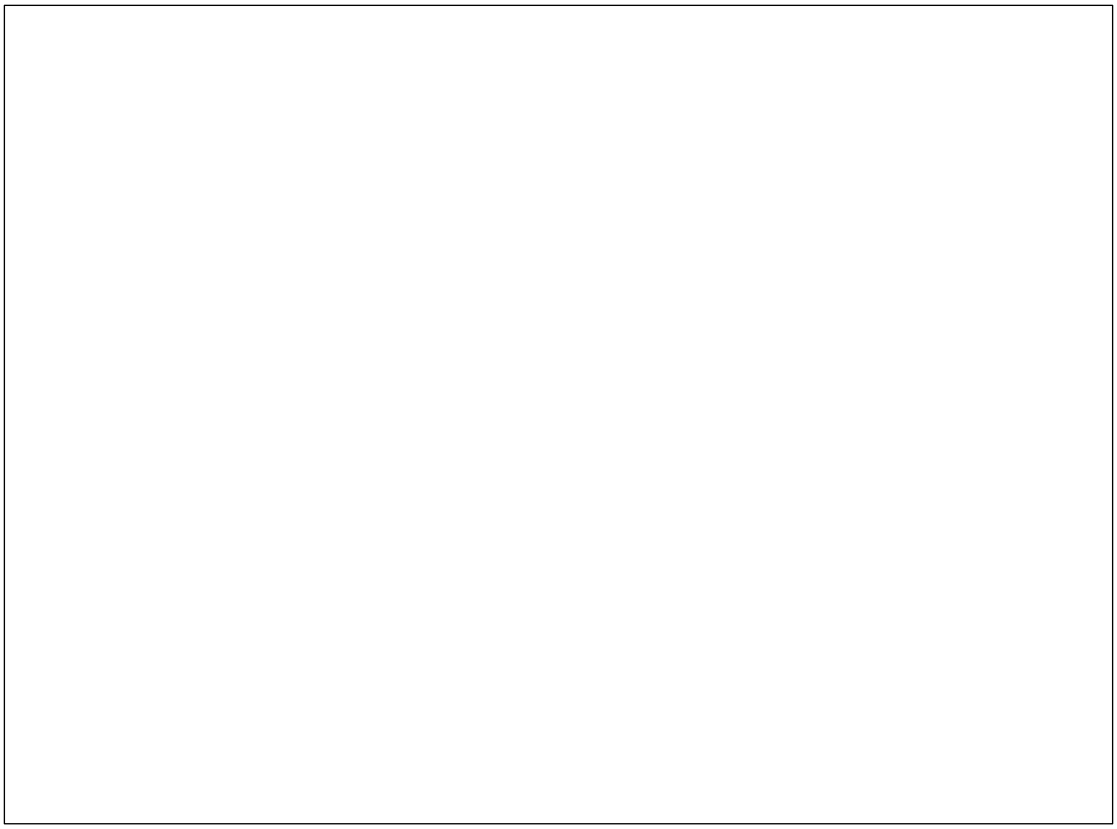

Figure 5.5: Screenshot of NSC Creative's main website http://nsccreative.com Image removed due to copyright restrictions.

The NSC Creative has played a progressively more prominent role in gallery design within the Centre. Its early role was less manifest; except for certain staff members (Paul Mowbray and Darren Clegg), early design in the years after 2001 was led by the technical team at the NSC (headed currently by Graham Law). Looking back, Mowbray reflects on how this may have made for a more product-centred than user-centred design (pers. comm. 26 February 2013). It is also worth noting that there was less need for digital production in the early years after opening; the first gallery to be redeveloped was *Space Now* in 2007, some six years after the Centre opened. (Parry & Crusciel, 2008; Law, pers. comm. 13 February 2013).

Since NSC Creative officially became part of the gallery redevelopments around 2008, '[they] are taking more of a lead role' in creating a UCD design focus, particularly on the 2013 'Sun, Earth and Moon' development (Mowbray, pers. comm. 26 February

2013). The NSC's Graphic Design Coordinator Clegg specified that his own involvement (and through implication, NSC Creative's first formal involvement in gallery development) came on the *Rocket Tower* redevelopment, where the focus was on designing for the range of visitors, especially multi-generational families that staff noticed were coming to the Centre (Clegg, pers. comm. 13 February 2013). Today, the Centre sees its approach as moving towards a 'user-focused' one, although, there has still been no use of visitors (as users) as an integral part of that process (Mowbray, pers. comm. 26 February 2013). Instead, the design team ensure they remain focused on who they are designing for 'by having someone who represents the end user, but they're not actually the end user', Mowbray points out (*ibid*). This direction on the NSC's part to make use of their own available design company shows they have fully embraced their staff skills to design their own galleries, with 'Sun, Earth and Moon', but that this process has occurred in stages since 2008.

2013 has seen a redevelopment of the production process at the NSC, which has seen the NSC Creative team members being the key players in designing new galleries. According to Kevin Yates (pers. comm. 31 January 2013), Exhibitions Development Manager of the new gallery redevelopments,

> there's been a realization that we need to take seriously the development of our galleries because they are getting old now and there are things that are failing consistently. That we need to have a more strategic approach, more thought out methodology, if you like, to help address redeveloping the galleries.

Over the last five years there have been redevelopments on a gallery-by-gallery scale, specifically Rocket Tower and the central Orbiting Earth area, but the NSC has come to realise that a more strategic approach to the entire Centre is needed, as all of the galleries are (in 2014) fourteen years old.

Mowbray captures the new direction that the NSC has developed to their production when he says:

> So it's trying to take a holistic view, really, and apply a traditional design process to the challenges of exhibition development rather than being technically driven […]

> [W]here issues have come from in the past […] maybe the priorities have been how can we…how can I put it…using an engineering mind-set – building something that does the job rather than taking a step back and thinking what are the challenges here and how can we make a better exhibition rather than what we can build out of this material, so let's do that. (Mowbray, pers. comm. 26 February 2013)

This move towards a holistic view of design shows that the NSC has adopted a mentality where their users are becoming more central to the process, in order to produce the best exhibitions for their visitors. This new direction that Mowbray explains has also allowed for the design team to become more focused on the requirements of the visitor (i.e. user-centred) as well as iterative in the design process, to create the best digital interactives they can.

It has been the expertise of NSC Creative over the years, with their external design projects, that has brought the understanding of user-centred design and its principles into the Centre's galleries. This can be seen in the 'Sun, Earth and Moon' section of the *Looking Up* exhibit (from 2013), where evidence of these new design principles were put into practice (Figure 5.6 shows a working concept model of the exhibit). For Exhibition Development Manager, Kevin Yates (pers. comm. 31 January 2013), it is this new design model that will characterise exhibition projects in the future. It is a model that encompasses as many people and ideas as possible, has people on the exhibition team from all areas of the Centre, and has them work together to create the best galleries, based on their staff knowledge and the knowledge of the visitor.[39] It is an aspiration we see echoed by the Head of NSC Creative, Paul Mowbray in his support of this new process:

> [w]e want to apply our skill set to the Space Centre, it's our home, it's our home site centre. It's crazy that we don't get to spend as much time and energy developing our own site versus a site in, say, Egypt. It's trying to find the balance and apply what we've built and allow the Space Centre to benefit. (Mowbray, pers. comm. 26 February 2013)

[39] Using staff from all departments and encouraging the sharing of ideas and teamwork was directly observed during project meetings as part of data collection for this project in January through April 2013 for the 'Sun, Earth and Moon' redevelopment.

What we hear in Mowbray's reflection, endorsed by the Exhibition Development Manager Yates, is emphasis given to the NSC's visitors and their place in the design process. NSC Creative, with their involvement in the exhibition developed in the Centre, are now better able to use their expertise from other projects, as well as their design knowledge, to create digital interactives that have come from a wide background of ideas and end-user requirements, ensuring that projects do not become technically focused, as the statement by Mowbray showed above.

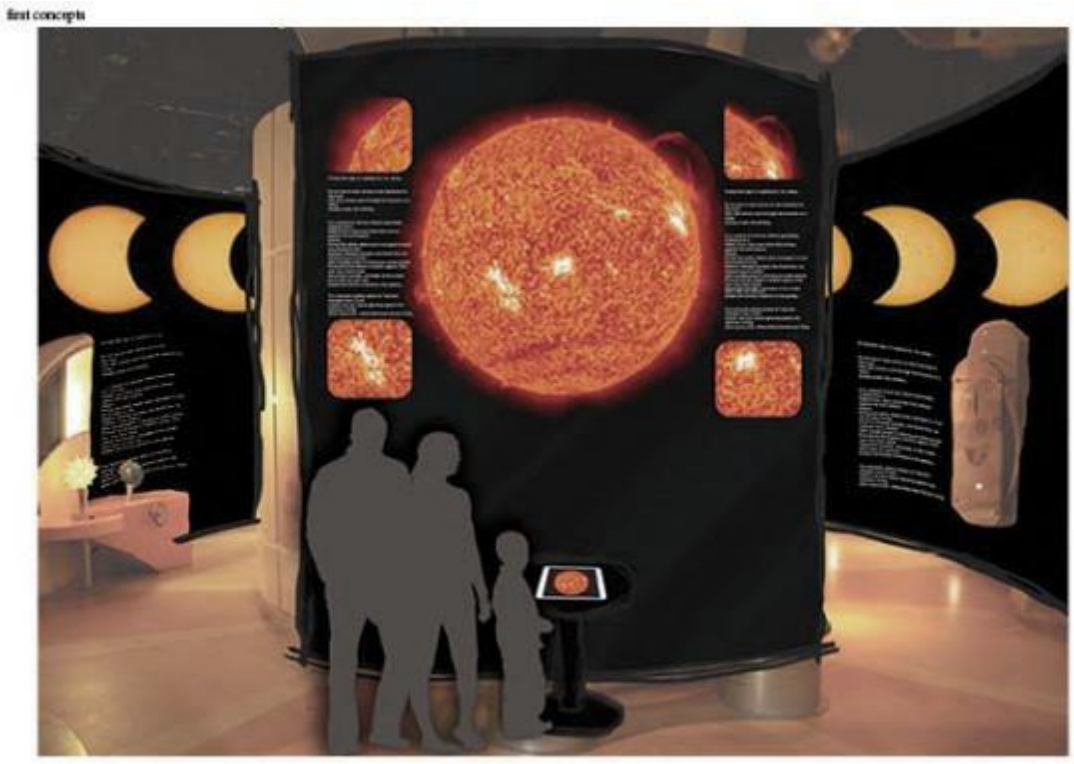

Figure 5.6: Working concept model of 'Today's Sun' interactive in *Looking Up* gallery. Image copyright of National Space Centre and NSC Creative, 2013, reproduced with permission of Darren Clegg.

5.4 The Herbert Art Gallery and Museum

At the Herbert, the process to redevelop the centre in 2003-2008 was a heavily involved production between staff and outside design companies. Staff believed they had enough knowledge of their respective visitors, from years of combined experience, to draw upon, without the need for public consultation regarding the galleries. As well, they relied on their design knowledge from previous galleries created in the 1990s (Taylor,

pers. comm. 15 April 2013; Roberts, pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013). A decade ago, the Herbert displayed similarities to the NSC, in that the design teams from within the museum's staff consisted of a project team for each gallery, with a curatorial lead and someone from the learning or inclusion teams as well. This ensured that each gallery was designed from the beginning by a range of people with various voices and opinions that could draw on their backgrounds and work together to create an exhibition based on a wide selection of skills (Taylor, pers. comm. 15 April 2013; Roberts and Jones speaking about Godiva and History galleries, pers. comm. 27 March 2013). However, these individual design teams for each gallery were only a starting point. The actual exhibition design and production were mainly organised through an outsourced company called Event Communications, with the digital interactives designed by Elbow (Roberts, pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013).

Figure 5.7: Recent projects displayed on Event Communication's website. http://www.eventcomm.com/work Image removed due to copyright restrictions.

The Herbert was able to use their knowledge of their objects, visitors and previous galleries to create designs that would showcase the museum's collections, while giving the more skill-specific work in design to outside companies with experience in heritage consultancy.[40] The Herbert's staff therefore focused their efforts on object selection and text panel development, with the curatorial team playing the largest part in this. An

[40] Event Communications has a long history of museum design: www.eventcomm.com/about, and Elbow Digital has experience with the latest technologies: elbowdigital.com/

example of the design brief that the gallery teams created as tender documentation in order to work with Event, to demonstrate to the design company what the Herbert's staff wanted included and what messages they wanted to convey to the visitors is included in the Appendix D. What the brief reminds us is how involved the Herbert's staff were with the redevelopment of the galleries, as it shows a detailed breakdown of what staff wished to included from the collection and subject area for each station within the gallery.

In 2010, Herbert Media was tasked to help create an in-house exhibition, in partnership with the curatorial department and Birmingham Museums, the first since the redeveloped museum opened in 2008. It was called *Secret Egypt* and was an opportunity to build on Egyptian collections and create a temporary exhibition that could also then tour around the UK (Herbert, c.2012). Figure 5.8 shows the exhibit in situ at the Herbert in 2011.

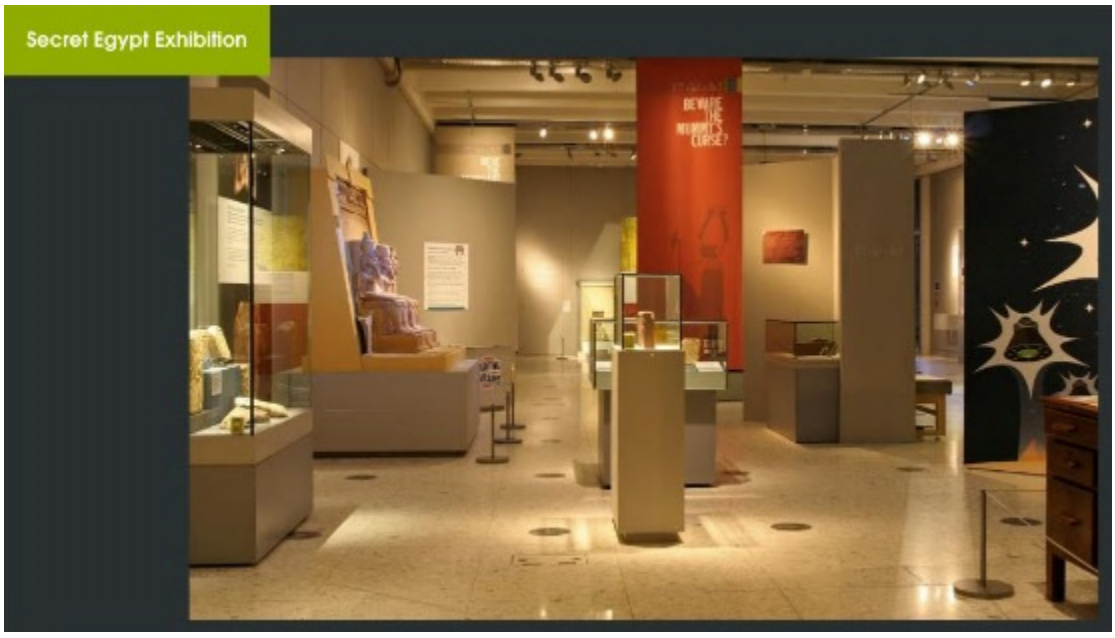

Figure 5.8: *Secret Egypt* on display at the Herbert in 2011, from website: www.theherbert.org/services-hires/currently-touring/secret-egypt reproduced with permission of the Herbert Art Gallery and Museum.

Herbert Media developed the interactive quiz 'Real or Fake' that was part of the *Secret Egypt* exhibition, creating the entire system in-house to accompany the in-house curatorial design of the rest of the display (Elms, pers. comm. 15 April 2013). This is an example of the Herbert building upon its existing staff skills and knowledge from

before the redevelopment, and its experience with oral history exhibitions, which characterised digital interactives in the early 2000s (Jones, pers. comm. 27 March 2013).

Since the installation of the *Secret Egypt* exhibition, however, the Herbert has gravitated back to an approach to digital production that has mainly used outside design companies, with staff knowledge of the collection to assist in the creation of exhibits. An example of this has been the development of its iPad applications. Herbert Media was partly involved, with an outside company, in the creation of an information app for visitors in 2011. The Herbert continues to redevelop the app with a more end-user focus to ensure that it is useful for visitors to explore the museum's collections (Elms, pers. comm. 15 April 2013). In 2013, the Herbert pushed to have another app created specifically aimed at school tours, to replace previously used worksheets available during the unassisted portion of school visits to the museum. Taylor, who spearheaded the project, noted that the museum planned

> [t]o work with [the external specialist] to create a rich array of content, some of which is image based, but also using things like video, oral history and so on, which we already have in our collections to create different…I suppose sort of trails and activities' to assist school visits to the centre. (Taylor, pers. comm. 15 April 2013)

It was, to the project leader at least, very much the Herbert's staff who were bringing the content to the application, with the external company responsible for the technical design – a return, in short, to the type of production that was initially used during the redeveloped galleries back in 2003-2008 (*ibid*).

Allowing staff expertise to underpin the development of content and collection related information for exhibitions and digital interactives, while relying on outside companies to create the digital system themselves has enabled the Herbert to focus on their visitors throughout the design process, and the staff have designed the interactives (as well as the galleries) specifically for their audience's needs (or their perceived needs).

5.5 Weston Park Museum

Weston Park Museum was redeveloped in the mid-2000s along a very similar design process to that of the Herbert. These two museums made use of external design companies, but ensured their own existing staff played a role in the design of each gallery. For WPM, the external company was Redman Design (Figure 5.9 shows their design of one corner of WPM's *What on Earth!* Gallery).

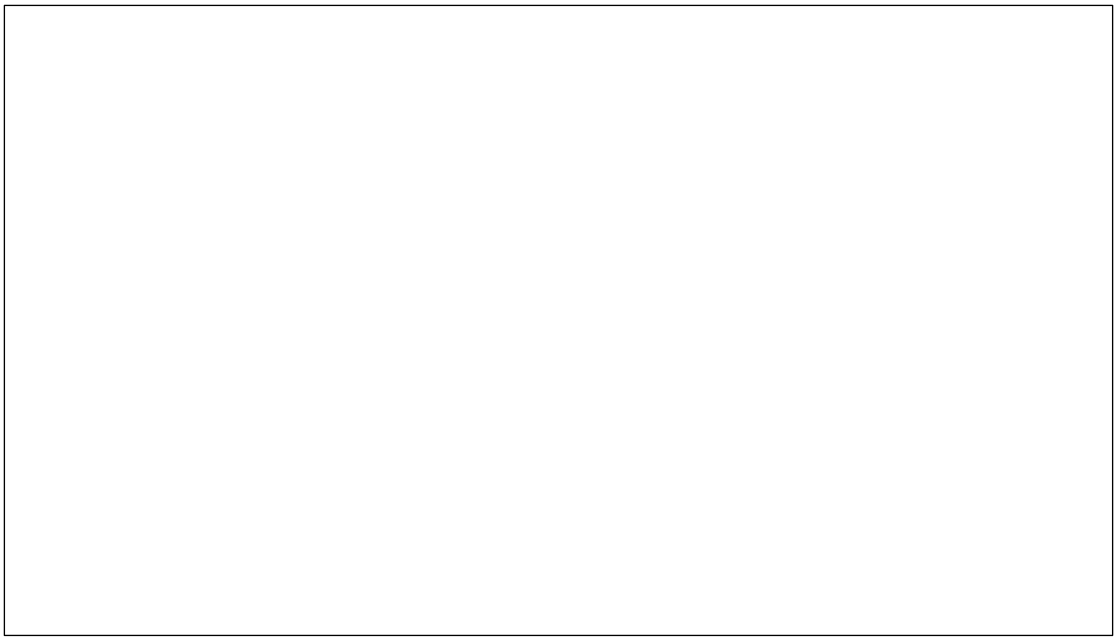

Figure 5.9: Screenshot of Weston Park Museum's project display on the Redman Design website. Available at: http://www.redman-design.com/#/projects/weston-park-museum-sheffield Image removed due to copyright restrictions

At Weston Park Museum, museum staff were especially focused on object selection and providing the background and knowledge for the subject-specific galleries. This approach to the gallery redevelopments allows for staff to use their own skills towards the use of the collection, while making use of the skills in design and interactive development from Redman. Natural History Curator Alistair McLean (pers. comm. 17 September 2013) explains: 'We set up a series of inter-disciplinary teams, working on the galleries. But the curators were the lead in each team. So if you talked to any other curators they would have been involved in their own disciplines displays'. Unlike at the Herbert, WPM relied heavily on the use of evaluation of the initial display briefs and also continued that evaluation throughout the ongoing development of the centre. Chief

Executive Kim Streets (2006) attested that this was 'led by [Manchester-based] Morris Hargreaves McIntyre'. The first level of evaluation was undertaken with the designers involved on the redevelopment and with the curatorial teams, after which a further evaluation was undertaken with 'potential visitors' (*ibid*). A further evaluation study was undertaken sometime later, after development was well along, in order to ensure that the gallery designs Weston Park Museum was planning to implement would work for the family audience and repeat visitors that staff hoped would frequent the museum (*ibid*).

At a more specific level, and more recently at Weston Park Museum, young people from the local area were involved in the design and interpretation of the *Treasures Gallery*. This community engagement process was part of the Cultural Olympiad, in the run-up to the London 2012 Olympics by Graham Moore, WPM's Children and Young People's Coordinator (Moore, pers. comm. 18 April 2013). Most recently WPM and Moore have undertaken a World War I exhibition project with local youth, which includes a video presentation that the young people assisted in creating (*ibid*). These projects show a continuation of community (particularly youth) engagement through the design process of exhibition planning and form a key part of Weston Park Museum's design focus.

The Arctic World gallery (for a design sketch, see Figure 5.10 below), designed during the redevelopment and aimed at younger children, was also created in consultation with a local primary school (Travis, pers. comm. 8 April 2013). This process by WPM shows a design with users intent, where the visitor and the collection are the key drivers of the design. However the museum's more recent digital interactives for exhibitions and design projects, since the redevelopment, have implemented the use of staff knowledge, with outside companies employing the skills to create the designs of complex interactives.

Figure 5.10: Artist's impression of *Arctic Worlds*, image copyright Museums Sheffield. Available at: http://www.bbc.co.uk/southyorkshire/content/image_galleries/weston_park_refurb_gallery.shtml?25
Image removed due to copyright restrictions.

The outsourced production, to Redman, of the original gallery redevelopments focused on the digital interactive design. Staff at WPM have completed their own designs on a number of temporary exhibitions, as well as the *Treasures Gallery*.[41] However, the digital interactives from the redevelopment were given over to designers at Redman (as were the rest of the gallery designs), as WPM's staff did not have the skills to take on such digital creations. Unlike the NSC and the Herbert, WPM does not have its own media or design department, and it is only select staff who work for Museums Sheffield who have some digital knowledge to assist with the upkeep of the outsourced digital interactives. Specifically, upkeep and repair of the digital elements has been left to William Bode, who Travis (pers. comm. 8 April 2013) explained has been 'our AV guy [who] spends a lot of time fixing the digital stuff up here'. What digital has been

[41] *The Big Bug Show*, *Colour Coded* and *Sheffield & the First World War* were all exhibitions put on by Museums Sheffield staff. Many of the exhibitions that have temporarily been held at WPM have travelled from other places, such as the V&A's *The Seven Treasures* and the V&A Museum of Childhood's *Magic Worlds*. Details about these exhibitions can be found: http://www.museums-sheffield.org.uk/museums/weston-park/exhibitions/past-exhibitions/

designed since the redevelopment by Redman has been, according to Hamilton (pers. comm. 11 March 2013) ‘as much about the enthusiasm of those [few] individuals for that type of learning as really to do with the resources to do them’. The issue with this design process at WPM has been mainly due to funding. The skills for complex interactives have not been available amongst museum staff, but neither has the funding for expensive designs for temporary exhibitions from outside companies (*ibid*). This has been the case except for rare examples, specifically the ‘Designed for Life’ interactive created as part of the *What on Earth!* gallery (the rest of which was engineered by Redman). This interactive was created by the natural history curator Alistair McLean, based on his own abilities with technology and algorithmic systems (McLean, pers. comm. 17 September 2013). The figure below show the main interfaces for the design game, and the accompanying television screen where visitors can observe the outcome of the creature design.

Figure 5.11: 'Designed for Life' interactive, *What on Earth!* gallery, WPM. Image by author, used with permission of Museums Sheffield.

Without McLean's knowledge, however, the interactive would not have been possible to produce by the museum. Hamilton specifically states that the lack of staff skills with digital, except in the rare cases of McLean and Bode, is 'the main reason we didn't end up developing a digital interactive because we were very anxious about who […] was going to be around to look after the thing' (Hamilton, pers. comm. 11 March 2013). This has made digital production at WPM less possible then at, for example the NSC, where the digital creation skills of staff within the Centre mean that there is less of a barrier towards development of digital interactives.

In 2013, Museums Sheffield created the new post of Digital Producer, which was filled by Alan Silvester. The intention was to bring further digital skills into the museum (Silvester, pers. comm. 11 March 2013). One aspect of Silvester's new position was to design an iPad app for Weston Park. Previously, there was an iPod Touch tour at Museums Sheffield's Graves Gallery, for a broad audience, but WPM has never had such a digital interactive (Travis, pers. comm. 8 April 2013). The design brief and requirements for the iPad tour were created in consultation with museum staff, but WPM chose, due to lack of staff skills, to tender the actual creation of the application to an outside design company (WPM, 2013). At the time of research for this project, a company to undertake the design had yet to be chosen.

Rather than following the type of design process used at the NSC or the Herbert, both with their own media departments, the majority of the development of digital products at WPM have been undertaken by outside companies specialising in the design of digital interactives. Although it should also be noted that limited resources have curbed the amount of outsourcing to companies that has been undertaken (Hamilton, pers. comm. 11 March 2013). This is a standard that WPM continues to follow to the present; its most recent gallery redevelopment, which will re-envision part of the *What on Earth!* gallery, was put out to tender for an external company to create (Travis, pers. comm. 8 April 2013).

The exploration, so far, of three very different museums shows each has had a different history of digital design. The NSC is characterised by production of digital interactives that it has largely taken on itself with internal staff, though it was originally designed, in the first instance, by an outside company. NSC Creative within the NSC has recently become a central part of exhibition design for the Centre. Whereas at the Herbert, where complex digital systems were used in exhibits, their design was outsourced to companies who specialise in such creations, but content management of the interactives was undertaken by staff and, through the help of Herbert Media, several programs have been instituted within the museum using their own staff skills (ex. *Secret Egypt*). At WPM, digital design has been done by outside companies, owing to (until recently) a lack of digital production skills within the museum. These three different environments of digital design provide us with a useful example of how other museums potentially

undertake their design of digital interactives. As we move forward, we take our question regarding child digital literacy assumptions into each of these case study museums to see if their design processes, staff design knowledge, and in-house skills have been a factor on the assumptions being made.

Before we move on to presenting the evidence towards an answer to the research question, it is useful for us to determine where in the design process we can look to find the evidence of digital literacy assumptions. In other words, what are the stages of design that these three museums go through in order to design a digital interactive for children? And at which point do they make decisions (and assumptions) about users? Central to this research, we must understand where the designers' expectations of the user are to be found in the process, in order to look within these expectations for our assumptions about children. In order to do this, we must look to the principles of interactive design, which is where our discussion now turns.

5.6 The Four-Step Design

5.6.1 How the Conventional Design Model is Used by the Case Study Museums

In chapter 4, the model of the four-step design process was discussed. This is the simplified process of: requirements-design-prototype-evaluate. Within this there is room to combine steps or add new ones, but the key components are the use of 'evaluate' during the project and defining 'requirements' early on. For museums, this mode of design is problematic. For one, as was already discussed, the user is rarely represented themselves within the design process, except in particular circumstances, such as the Treasures Gallery at WPM. Rather, the user is the audience the design is meant to be for, and staff and designers rely on their previous knowledge of other designs and outcomes in order to design for the end user. In doing so, they detail requirements, but not to the extent that design processes from the field of user-centred design would seem to require. In the museum design briefs from a decade ago at both the Herbert and the NSC, there are more basic descriptions of the user, such as 'children' or 'families' or 'Key Stage 2', and there is little evidence that a long discussion to identify exactly what users' needs were was conducted before the designs

were initiated.[42] *Requirements*, then, for most museums, are a general idea of the end user, based on previous designs and use in the galleries. The idea of establishing requirements to understand how the user communicates and interacts with others does appear in staff reflections on previous designs, though it is not as obvious in the design briefs themselves. This is where the staff has assumed that visitors will engage in conversations with each other while using the interactives, but in practice this has not been the case.

It is the next step in the process, *design*, which is not as obviously seen in the research collected for this study at all institutions. Design is characterised by a range of activities, but most specifically it has to do with the earliest designs (before initial prototyping) and mock-ups of the end product that reflect the requirements identified for the exhibit. Design briefs produced by the museums and their external design companies are commonly found at the Herbert, WPM and the NSC, but they are very simple, characterizing the most basic requirements and ideas behind the designs (see examples in Appendix D). They were meant only as a first step in the process in discussion with external designers. As such, design briefs are not easily found for more recent, in-house projects, particularly at the NSC, where project designs are shared within personal emails and especially through meetings within the same office.[43] A paper trail is less clear and accessible for a researcher to follow when there is no back and forth between the internal museum and an outsourced company. As such, identifying assumptions made about children and their digital literacy within this particular phase does pose a problem in this study. However, as the design phase is based directly on the requirements identified in the first step, and before prototypes for users to test are created, that the vast majority of the assumptions about children have already been made during the requirements stage.

Within the issue of documentation is also the prototyping phase. *Prototyping* is an important part of the design of digital interactives (as well as any type of museum exhibit) and is most useful when evaluating with the end user. For the redevelopment projects and the creation of the NSC, prototype mock-ups can be found in

[42] This suggestion is based off the data and documentation collected for this study. The documentation does not show a lengthy requirements or user discussion, and staff interviews did not present any further evidence that a lengthy discussion about users was had at any point in the design process.
[43] This was observed during project observation at the NSC in 2013.

documentation, though they are few and far between. It is likely that the external design companies who were not available for contact for this study keep more data. There is the possibility that this is not likely as data was collected from Haley Sharpe Design, the external company that created the initial design for the NSC, and no prototyping documents were uncovered in their archives.

The only quantity of prototyping files uncovered was from the Herbert, which seems to have kept much of the design archives from before the 2008 reopening of the museum. The Herbert's interactive prototyping, relating to the pocket watch interactive in the history gallery, is a design schematic of each page of the interactive, with notes suggesting details such as what text to include, images, and learning outcomes (Figure 5.12 below).

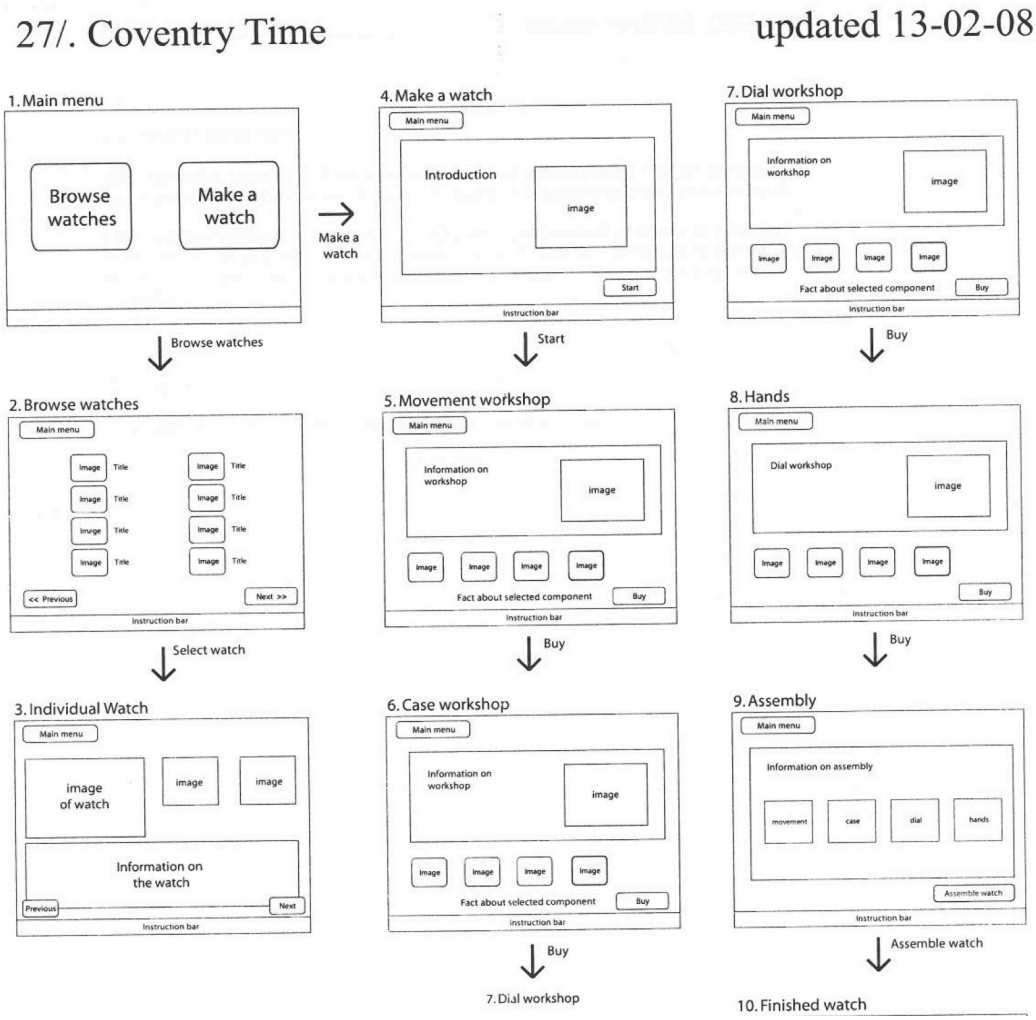

Figure 5.12: Coventry Time prototype drawing. Image copyright The Herbert, reproduced with permission of Martin Roberts, Senior Curator.

In the case of the more recent interactive for the *Secret Egypt* exhibit at the Herbert, a script used by the actor who provided the voice for the game is also included in the prototyping brief. This is the most detailed type of prototyping found in the data collected for this project, although there are some computer design schematics for the recent NSC redevelopment of the 'Sun, Earth and Moon' section of *Looking Up*. The NSC has found it very difficult to prototype their own designs, due to the nature of the technology they use (mainly computer programs); they need an end product to show the user, but the end product is only available on completion of the entire project, at which point it is difficult to work through an iterative process. As the NSC is unique amongst the institutions for this study, as they have their own internal and skilled design office, such issues do not necessarily apply to WPM or the Herbert. However, as with several aspects of the data collected for this study, it is unlikely that the data never existed, rather that it is not accessible for study.

The requirements stage of the interactive designs for the Herbert, WPM and the NSC uses previous user information and experience collected from years of designing, and it is in this stage that evaluation should play a key role. This was certainly true for WPM, which hired an external company to undertake visitor evaluation of the redevelopment and new designs prior to progressing further in the process. Evaluation in museums is a key part of any project, as it is the most organised way to gather feedback from visitors about their experiences (Hooper-Greenhill, 1995). There is often little time to undertake formal evaluation, though even an informal study can be useful. The museums in this study, however, have undertaken little detailed qualitative evaluation over the years, due mostly to a lack of resources (particularly time and staff). WPM relies on visitor feedback through comments, as well as informal observation by individual staff to understand how engaging and popular their interactives are.[44] According to the museum's Children and Young People's Coordinator:

> [t]hings move on and that's the other frustration. Projects…there's a lot of time and energy and commitment that happens, but then there's always the next project. Hopefully you evaluate a little bit, but there's never time to turn around

[44] Gallery observation by visitor assistants such as Eloise West, who was interviewed for this study but did not wish to be quoted, are used as informal evaluation of the galleries (temporary and permanent).

> to somebody and say, you know, we haven't quite finished that because everybody's on to the next one. (Moore, pers. comm. 18 April 2013)

WPM have made use of the services of researchers (in one case a PhD student) who have looked at children's museums, pre-school learning, and the way space is used for each, a process that has then fed back to the museum to further develop their programmes (Travis, pers. comm. 8 April 2013). Visitors also contact the museum through email and Facebook in order to feedback to staff on their experiences (*ibid)*.

The Herbert has had similar limited resources since reopening and the head of their media team believes that there has not been enough evaluation of the interactives to understand how the audience uses them:

> I think some of the digital installations we've got are quite popular. I'm interested in finding out more about digital, all of us, as a sector. I don't think that we've studied the way that audiences use all interactives, not just digital interactives. I think that's what's wrong with our sector, that we don't evaluate much. (Elms, pers. comm. 15 April 2013)

Martin Roberts, Senior Curator at the Herbert, sees a similar issue with evaluation of the entire museum in general: 'Since we opened, we've done a number of market surveys. […] we've carried out some evaluation of how visitors use the spaces. We need to do more of that before we draw any definitive conclusions' (Roberts, pers. comm. 27 March 2013). This statement by Roberts applies to the galleries in general, and not specifically the interactives, but combined with Elms' declaration about the lack of digital installations studied at the Herbert (and elsewhere, he implies) it is clear that the Herbert has not engaged in in-depth evaluation in order to understand how young visitors use digital in museums.

The NSC has relied on evaluation only when required to do so, because of external funding for a development project. Exhibitions Development Manager, Yates, sums up the situation on evaluation:

> But formal evaluation of it, at this stage, we didn't have a funder, we paid for [the redevelopment] ourselves, so if someone's funded it we often have an obligation to do formal evaluation. To show them that, to give them evidence they spent money in the right place. With us, in a sense, if we don't have any money to put anything right then paying someone five thousand pounds to come in and evaluate it and say 'yeah you need better content in the Tinytarium, yeah but we spent five thousand on the…' So that's the thing. If we haven't got any money to invest improving things … [it] raises the question why would you spend money you haven't got on getting someone to tell you that you need to improve it. (Yates, pers. comm. 2 September 2013)

When museum staff conduct a project without outside assistance or stakeholders, finding the time and resources to evaluate it after the fact is difficult as there is always another project to move on to, even if resources allow for evaluation. Mowbray (pers. comm. 26 February 2013) also agrees with this statement, saying that

> [evaluation] has to be at the right point in the process. That's always a challenge for us because very often the finished product isn't finished until the product is finished. How do you prototype things, which give enough information to the audience that they can give an informed opinion of it in evaluation that's actually useful? And you don't get caught up on things because they didn't realise something was wrong.

This also, tying in with the earlier discussion on prototyping, suggests why prototyping may be difficult to implement at level that allows for actual testing, at least at the NSC.

The most formal evaluation study at the NSC was undertaken by the University of Leicester on the *Space Now* gallery, before and after redevelopment, and focused mainly on understanding how visitors move through the space and what exhibits would be most engaging for users (Parry and Crusciel, 2006 & 2008). The NSC has found it impossible to undertake a similar study since then, and relies now on its staff's informal observations in the gallery spaces and comments from visitors (Yates, pers. comm. 31 January 2013; Howell, pers. comm. 13 February 2013; Law, pers. comm. 13 February 2013). However, the NSC were also quick to mention that, despite their attempts to do

project evaluation with visitors, they are keen to continue their use of evaluation of the process of design and the design team, to ensure they are using the correct staff for the project and working in a way that best meets the requirements of designing exhibits (Mowbray, pers. comm. 26 February 2013). For the most recent 'Sun, Earth and Moon' design in the *Looking Up* gallery, there was the opportunity during exhibition set up in the month before opening to invite visitors and staff to use and comment on the interactives, providing a short window of time to correct any small issues that were identified (Yates, pers. comm. 2 September 2013; Howell, pers. comm. 12 August 2013). This was, however, unusual for the NSC as the 'Sun, Earth and Moon' redesign was the first time they had run a project with no specific timescale, allowing them the opportunity to evaluate at the very end and use an iterative process. They are hoping to continue this design process format in future projects (*ibid*).

Based on this evidence, it would be reasonable to conclude that over the last decade and a half, the four-step requirements-design-prototype-evaluate method of design in museums has not always been observed or evenly executed by the three museums considered here. As museums rely on a design for the user mentality, the requirements stage is characterised by previous knowledge about the visitor, rather than new information acquired for a specific project. As well, sometimes the requirements of the technology can outweigh the requirements of the user, leading to a lack of focus on the ultimate goal (as Paul Mowbray suggested in his 2013 interview). The design stage is difficult to uncover and may reflect on the fact that design documentation was not properly archived for past projects in all three of the museums. Prototyping also suffers from a lack of documentation, but it is often difficult to prototype for the visitors as early designs are often kept amongst the design staff only, before the finished product is usable by the visitor. This also makes evaluation throughout the process, as several authors reviewed in Chapter 4 suggest, difficult. The museums, when they can, engage in summative evaluation at the end of a project, however, the timing and depth of this evaluation does not always allow for there to be subsequent changes to exhibits (with physical or digital elements). It is clear that museums individually engage in their own set of design processes, and often the staff involved and the resources available for the project determine these processes. Understanding that there are such differences between the Herbert, WPM and the NSC illustrates the similarities in assumptions, detailed in the next chapter, more noticeably.

For the institutions that participated in this research project, it appears that their design process may have similarities. For example, evaluation, particularly at the NSC, which undertakes their own digital interactive design, is not common for projects, pointing perhaps to the suggestions that evaluation is less common in projects done in-house than with projects mostly created by outside design companies (such as at the Herbert). Also, for example, prototyping is more formal and more common at WPM and in certain design projects at the Herbert, as outside design companies (who undertook these exhibition projects) seem more likely to engage in prototyping (at least in paper format, if not in full computer prototyping). In the requirements stage, more formal requirements for users through evaluation studies and understanding of the end user before starting the design process seems more likely when the design is outsourced to a design company, such as the visitor consultation from WPM's redevelopment, but is not so apparent at the Herbert, which relied on its staff understanding of the museum's visitors during redevelopment.

As this thesis moves into Chapters 6 and 7, the differing design processes and levels of staff involvement may explain the gaps in assumptions that will become obvious. It should be noted that the gaps found in the assumptions in the following two chapters are not, necessarily, because staff did not make assumptions about children's digital literacy in their designs, but rather because there are gaps in the design processes themselves during which assumptions could not be made. For example, it is difficult for staff to make assumptions about digital literacy during the evaluation phase of design when there is no evaluation phase.

5.6.2 The Four-Step Design Model as Structure

The four-step design model introduced in Chapter 4 and detailed above within the institutions, serves mainly as a rationalising strategy for analysis of the fieldwork. It is a device for organising the fieldwork data during the analysis stage in 2013 and 2014, allowing for the opportunity to compare and contrast the case study museums within each step of the design model. As such, interviews, documentation and observational data could be broken down to each step of the design process, and that data could then be understood in what impact the digital literacy assumptions made in that step have

had on the overall design. The four-step process has also been used to form the structure of Chapters 6 and 7, to allow the data that was analysed under each step to be differentiated in the discussions presented there. This four-step design model is, therefore, not directly related to the theory of digital literacy, which forms the basis of the thesis question. It is, rather, a structural method of analysis and, perhaps, an opportunity for future research. The data presented in this research suggests that the digital literacy assumptions that are made earlier on in the design process (that is, the requirements and design stages) seem to be greater in quantity. It can be suggested that such early assumptions would perpetuate throughout the later steps of the design process and therefore impact the final design in a larger way then assumptions made near the end of the project. However, this is a future direction of research that could be explored at a later date, with a wider view of museums and their understandings of digital literacy, as well as their design processes.

5.7 Conclusion

This chapter has given the reader a chance to become familiar with the three institutions in this study. This chapter has explored how the museums in this study were chosen for their subject matter and design projects, to offer a variety of different methods of approaching digital interactive design over a number of years. However, this chapter shows that there are similarities across the three case studies, particularly within certain projects in how staff approached their design, involvement levels, or in how designs were outsourced to other companies. The four-step design process introduced here will characterise the structure of the discussion in Chapters 6 and 7, during which assumptions will be discussed and analysed between and across institutions. Assumptions made by staff at the three institutions have been found by looking at each step of the process separately to narrow down the data collected. The design process suggests that assumptions are most likely to happen during the requirements phase, however assumptions can be found in each step of the process.

As we look back on the previous chapters, we can see that Chapter 2 has given us the literary context for this project, examining the digital provision for children in museums over the last several decades. Chapter 3 has provided the theory of digital literacy in which this thesis explored staff understanding of children and the assumptions they

make about their digital abilities. It has also demonstrated that the literature on digital literacy sits mainly within two, very different, views of how digitally literate children are: realistic and optimistic views. Chapter 4 has added the context for how to analyse the data collected, examining the literature on user-centred design and proposing that the four-step design process can be used, in this study, to understand the design of digital interactives in museums. In this chapter, we have examined how the three case study museums are examples of various ways to approach the design of digital systems, and how these methods (and the museums) differ from each other. We have also seen how these types of digital design have affected the four-step process for projects at each of the institutions. We are now ready to turn towards the discussion of three English institutions, over fifteen years of design, to view their staff assumptions about digital literacy in children and how these relate to the realistic and more optimistic discourses.

Chapter 6: Realistic Discourse on Child Digital Literacy within Interactive Design

6.0 Introduction

The underlying debate that drives this research project is the differing discourses in views of digital literacy, and how these are manifest within museum design processes. That is, that there is one discourse that can usefully be considered the realistic perspective, which regards child digital literacy as low and assumes children must be taught digital literacy in order to become digitally literate.[45] In contrast, the optimistic discourse believes that the use of digital technologies in and of themselves can lead to digital literacy and that children today are predominately literate because of their increased exposure to technology.[46] This study brings this debate (informed from media studies and media literacy theory) into the museum sector, by comparing and contrasting staff assumptions about child digital literacy to see where the realistic and optimistic discourses appear, and how often they appear, when designing digital interactives. In doing so the study aims to uncover the assumptions that can be found within digital design in museums, but also to suggest that there is a complex relationship that exists between academic research (in this case on child digital literacy) and museum practice.

This chapter and the next are divided between the academic and popular debates surrounding digital literacy and their appearance in three museums. The format of these chapters is informed and structured by the user-centred design theory and the Four Step process of design outlined in Chapters 4 and 5. This four-step process is, as Chapter 5 explained, used as a way to structure the presentation of the data in these analysis chapters. It also served during the analysis stage of the research to highlight similarities and differences between the museums in their digital designs and assumptions. The realistic assumptions made by staff are highlighted across digital projects undertaken

[45] This view comes from Selwyn's (2009) intention to find a realistic understanding of children and their digital literacy capabilities.

[46] The optimistic viewpoint comes from Buckingham (2007 & 2008), who ascribes that the assumption that children are innately good with technology is too optimistic a view and should be couched in more measured terms and more scientific inquiry.

since 2000, including the redevelopments of the Herbert and WPM and the creation of the NSC, up to 2014. This amounts to some sixteen projects in total. The realistic assumptions in these museums will be discussed first, before moving onto the more prevalent popular discourse based assumptions, as many of the projects discussed here share both aspects of the child digital literacy debate. Within the academic discourse assumptions made in these museums there are notable similarities in opinions that relate very clearly to the measured approach to digital literacy made in the academy. In contrast, the optimistic based assumptions discussed in Chapter 7 are often more varied and found in a larger number of staff.

Overall, what emerges in this analysis is a clear representation of the realistic perspective from staff that believes that children are not by their nature digitally literate. This is seen through the design assumptions that adhere to simple, rather than complex interactives, using familiar technologies. What is most striking in this discussion is the noticeable shortage of assumptions and expectations about child digital literacy that align with the realistic viewpoint. Though the realistic assumption can be seen in the following projects, they are seen in a way that does not dominate the design. Furthermore, when the projects are viewed across the fifteen years of design detailed in this chapter, there is a noticeable continuity in the type of realistic discourse that can be seen from staff members. From 2000 to 2014 the evidence of realistic assumptions (in the processes and the products), across these three case studies remains largely constant, which is in contrast to the changes in media literacy literature and scholarship during this same period, detailed in Chapter 3.

As was stated in Chapter 1, in the methodology section, data collection was approached in order to uncover digital literacy assumptions. For interviews, this meant that staff were given a brief explanation of the concept of digital literacy and it was explained to them that this research intended to uncover assumptions that staff felt aligned with digital literacy. In terms of the documentation and critiques examined in this chapter and the next, digital literacy was explored within them based on comments staff had made regarding what they perceived as digital literacy issues. The triangular approach to data collections means that the documentation and critiques (in the case of the NSC, project observation as well) supported the staff comments. Due to the nature of qualitative research, it is possible that certain aspects of the documentation and critiques

examined here, which are shown to contain digital literacy assumptions, may have other contributing factors that have influenced them. However, as this study specifically seeks to understand assumptions in digital literacy, it is the staff at the museums and their comments that have dictated how this information is viewed.

6.1 Realistic Discourse at the Requirements Stage

In Chapter 5, we have seen that the requirements for an exhibition or interactive is the first step in the process of creating an interactive (or other aspect of a gallery) for a museum audience. It could be equated with the brainstorming stage of writing, or identifying a research question for a thesis. It is where the basic understanding of the user is outlined, and where the end user (the visitor) must be understood, before moving into the more specific design stage of the process.

Each section of this chapter will look at the three case study museums over the last fifteen years of design[47], using projects in the last ten to fifteen years to present the data. In this section, the inaugural design of the NSC (in 2001), and the redevelopments of the Herbert and WPM are measured with respect to the realistic assumptions made by staff around child digital literacy. This allows for the question of change in expectations, which supports our understanding of what assumptions have been made, to also be explored throughout the chapter.

6.1.1 Assumptions at the NSC

The National Space Centre began with a single clear purpose: to educate the next generation of scientists (Hauser, 2006). As such, the Centre has always had a core academic element to it. Within digital literacy, however, this realistic discourse is less clear. Academic discourse, widely, does not adhere to the concept that children are by their nature digitally literate, but must be shown or taught to gain levels of literacy above simply the ability to access information digitally. In the *Looking Up* gallery that was created for the NSC in 1999 to 2000, one of the key requirements was to design for

[47] In this requirements section, the word 'design' will be used to refer to the entire four-step design process as well as the act of creating a digital interactive (starting with requirements).

a wide audience, of all ages (Figure 6.1 demonstrates the original gallery, showing the 'Earth' section).

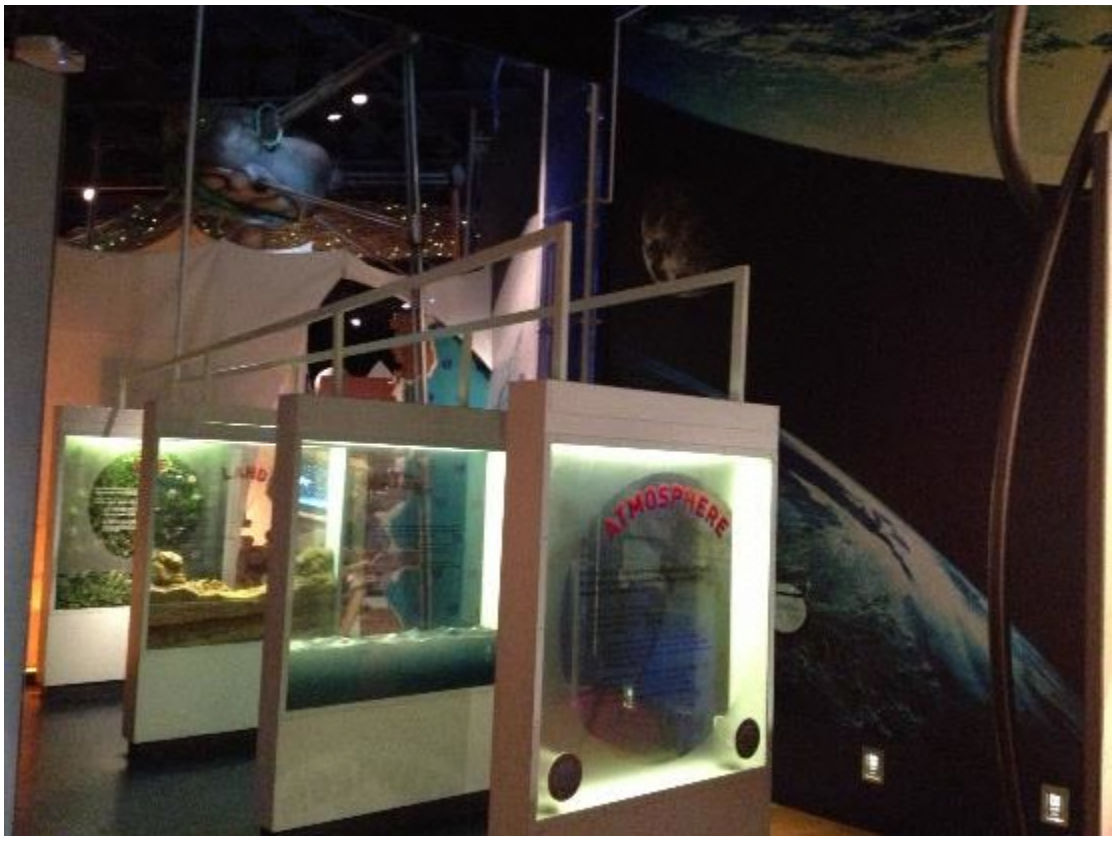

Figure 6.1: Earth section of *Looking Up* gallery. Image copyright NSC, reproduced with permission of Kevin Yates, NSC.

This gallery focused upon the planets of the solar systems, including the sun and the system's moons. Instead of using available digital systems, which are prevalent in the rest of the Centre, the design of this exhibit took a more static approach.[48] The project team reasoned that such an approach would appeal to a wider audience (Bishop, 2006). The designers of this original exhibit of the Centre decided that the best way to convey factual information in an educational context to children (and adults) was, rather than interactives, to use text panels in varying shapes and sizes. This is, perhaps, supported with the fact that many of the interactives in the Centre when it opened were similar in nature to competitive games, rather than factual information stations. This approach, making use of text panels instead of digital to convey information, meant that the issue of digital literacy did not affect the design. Rather, a tried method of displaying

[48] Observed during personal tour of the NSC by researcher.

information was used in the gallery, without designers needing to concern themselves with how well visitors might be able to access the information on a computer system.

There have been two main projects undertaken at the NSC since the Centre opened in 2001. These are the redevelopment of the popular Space Now gallery in 2006 and 2007 and the renovations of the Rocket Tower section of the Centre, which began in 2009.

Beginning with the Space Now redevelopment, the gallery that was created for the 2001 opening employed heavy use of digital interactives. The new space built upon this interactivity and many elements from the original gallery (types of technology) were kept, but were updated. This redevelopment was the first since the Centre's opening, and therefore the first in-house project that staff were involved in. The new central focus of the Space Now gallery became the touchtable in the entrance area (Parry and Crusciel, 2008).

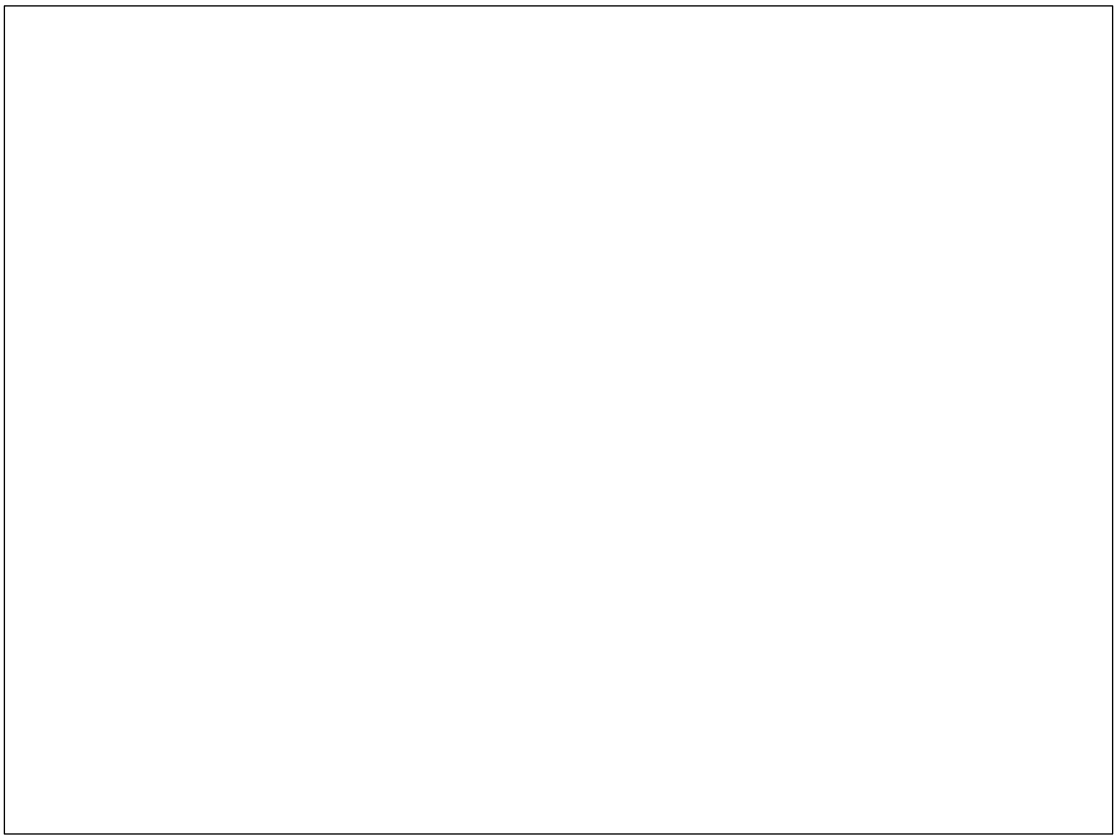

Figure 6.2: YouTube video of Chris Hadfield from space, interactive table, *Space Now* gallery. Image removed due to copyright restrictions. An example of the Space Now table can be found at http://www.spacecentre.co.uk/tour/space-now#!prettyPhoto[gallery8b62386f08]/4/

The table consisted of YouTube videos of recent space news (Figure 6.2 shows the most recent YouTube video from summer 2013), as well as text to explain them. According to the Centre, the videos were placed there for children to use, while the text (and perhaps by extension the other more static areas of the new space) were for adults (Yates, pers. comm. 31 January 2013). There is an implication here that staff assumed that their visiting audience would prefer different levels of interactivity, and that children might not engage with explanatory text, but rather videos and the touchscreen capacity of the table. This does suggest that the Centre displayed characteristics of the realistic debate, whether they were aware of it or not, more prevalently than the optimist perspective when assuming child digital literacy. Those characteristics can be seen in the assumption that children are less likely to engage with deeper levels of information and instead will be entertained by the availability of buttons to hit or press, a concept inherent in touchscreen technology.

A similar trace of realistic reasoning is also found in the *Rocket Tower*, which came several years later. This redevelopment built upon what staff had learned from *Space Now*. Therefore this project represented the opportunity for the project team to call upon their past experience to create a more thorough list of requirements, adhering to the 'design for user' mentality (Yates, pers. comm. 31 January 2013). Though much of the newly reworked gallery was static and involved text, on the top floor there was an important experience created for children (Gallery Observation of *Rocket Tower*, 2013).

Figure 6.3: *Rocket Tower*, top floor interactive, control station. Image by author, used with permission of NSC.

The objective was that young and older children could use the system together, but because of the scientific complexities apparent in recreating a 'space mission', the experience was kept very simple, with few steps, so that all ages of children could use it, as the limited instructions in the picture above show (Law, pers. comm. 13 February

2013). Figure 6.3 shows the control side of the experience, and the one typically used by older children and adults. There was the worry that, if it became too complex, that is to say, too many steps or instructions, children would not understand it and become bored (*ibid*). Again, in the Centre's justification for the design, there are expectations of use made here, consistent with the realistic discourse of child digital literacy - that younger children especially will not be able to use complex interactives or understand their purpose, and that physical interactivity is better than digital interactivity that may be too complicated.[49]

Clegg[50] spoke about how he designs for the NSC audience, which is mainly families: 'some bits we want…are more intellectual and some bits for kids who just have fun. […] When you're doing things for kids, just keep it as simple as possible' (Clegg, pers. comm. 13 February 2013). It applies to all types of gallery design, but Clegg is mainly involved more recently in interactive and graphics design. Reading Clegg's responses carefully we notice a perception that children do not necessarily come to the Centre to learn, and therefore may not desire an educational visit. As the Centre bills itself as an enjoyable experience, this is not a surprising assumption on behalf of museum staff, and likely one that is true for many visitors. Children will, however, find the visit more enjoyable if the exhibitions are kept simple and if the interactives are simple enough that children can use them. This assumption implies that, like realistic discourse, children do not actually have an outstanding ability with technology and that simple to understand interactives are more likely to appeal to them than complex ones.

In 2013, a small exhibit was added to the *Space Now* gallery.[51] When discussing the design of the exhibit, and the reasoning behind its static nature, Yates suggested that

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[49] The optimistic viewpoint of child digital literacy sees children as able to intuitively use the digital technology presented to them, and is not concerned with how complex that technology is. An iPad, for example, would be considered a complex digital system to use, but the optimists' discourse believes even young children can use such a device without training or assistance.

[50] Darren Clegg is one of the main staff at NSC Creative, the design and production company that exists as part of, but separately from, the National Space Centre. He is the Graphic Design Coodinator for the company, with many years of experience and was brought on board the exhibition team for the *Rocket Tower* in 2008.

[51] This project consisted of a model representing a device that measures infrared. It was in partnership with the University of Leicester, and was an addition to the Space Now gallery. It was designed to be static – the model could not be touched, and the rest of the display consisted of text and graphics (Project Meeting #1, NSC).

getting children to look at something in a museum is not as difficult as getting children to understand and consider what it is they are actually seeing:

> At lot of the time with the kids we see it is the parents or guardians with them that make all the difference in how much they get out of the visit. You're with the table and kids just come and hit all the buttons on the table and they just run off, you know and come back and fetch father and 'come look, if you hit it it flicks'. They're not actually using it in the way it was intended. (Yates, pers. comm. 31 January 2013)

Though designing an interactive that is easily used by children is difficult, providing a framework for children to engage on a higher cognitive level, to consider and analyse an object, picture, video or interactive, is especially challenging, Yates understands. This perspective suggests that, to Yates, children are not as visually literate (and by extension digitally literate) as optimistic discourses might suggest.[52]

6.1.2 Assumptions at WPM

Reflecting on the redeveloped at Weston Park Museum, the Executive Director Kim Streets (2006) explains that the new galleries were designed to be layered with information for various types (and by implication ages) of visitors. There was the clear acknowledgement that different visitors required different experiences, particularly, according to Streets, from the interactives in the exhibits (*ibid*). This is further stated in the interactive strategy for WPM, which states that 'interactives should be as intuitive as possible, but simple instructions will undoubtedly be needed' (WPM, c. 2006: 12). This suggests that the staff during the redevelopment were aware that how interactives work is not always obvious to visitors, but the explanations of how to use an interactive must also be clear for all age levels. This suggests that (at least some) staff, at the time of the redevelopment in the early 2000s, were sensitive to the fact that their family visitors might struggle with levels of digital literacy and not easily be able to even access the digital in the gallery spaces without help. Within the 'Designed for Life'

[52] An aspect of digital literacy touched upon in Chapter 3 by Eschet-Alkalai, the idea that we learn and understand through visual observation of photographs, text, video, etc. that is presented digitally, and therefore forms a part of the greater discourse of digital literacy.

interactive that exists in the *What on Earth!* gallery, the system was designed specifically for children over the age of eight, which suggests that McLean, who designed it, thought that children under eight would not be able to use the interface or perhaps find the idea behind how the digital was presented too complex without at least parental help (McLean, pers. comm. 17 September 2013). The bright colours and font design seems to appeal to a younger audience, and the clear 'Start' button ensures that visitors will know what to do once they approach (as Figure 6.4 shows).

Figure 6.4: Main screen of the 'Designed for Life' interactive, WPM. Image by author, used with permission of Museums Sheffield.

This is corroborated, in the project archive, by the gallery design brief for *What on Earth!* which states that in the same area of the gallery there was another interactive that was simpler and aimed at younger (under-eights) children, as the 'Designed for Life' game might be too complex for them (WPM, 2002: 13). The brief, which covered the aims, messages, target audience and general specifications for the entire gallery, states about the specific exhibit that a nearby 'simpler interactive allows younger visitors to offer food to an animal. Inappropriate food makes it throw up and die' (*ibid*).

This provides a useful expectation from the designers on the digital literacy of different ages of children, separated here into 'younger visitors' and families (*ibid*).

Similarly, a section of *Sheffield Life and Times* was originally designed to have an interactive for older children and adults that complimented the same ideas, but would 'not be suitable for young children' (WPM, 2003: 5). This suggests that either the information presented on the interactive in *Life & Times* was too complex, or that the system itself was too complex for young children to use (though it was likely a combination of both).

As Weston Park Museum reopened to the public after its redevelopment only in 2006, there are few interim projects to showcase requirement assumptions about children's digital literacy through the later 2000s. The only project that stands out for this study is a Museums Sheffield 2009-2010 project focused on insects. The exhibition that ran at WPM during the time was called *The Big Bug Show* in the temporary exhibition space of the new museum. The exhibit was mostly static displays on insects and text panels, but there was an interactive that allowed visitors to design a super-powered bug. It was specifically aimed at older children (WPM, 2009). There is an implication that can be seen here that staff members who created the exhibition assumed younger children were not digitally literate enough to understand a complex interactive system, and this is backed up by the creature design game 'Designed for Life', which was also not aimed at young children. There is also the implication, however, that older children would therefore have fewer usability issues, by being able to follow the instructions towards a specific intention (design a bug). The support of realistic discourse in digital literacy here is not only noticeable; it is also the main expectation for the design of these very similar interactives, separated over several years.

At WPM a new project was in development for 2014. The staff, led by new Digital Producer Alan Silvester, was planning a Wi-Fi treasure hunt that works on a smartphone platform (Silvester, pers. comm. 11 March 2013). Though the system is intended to appeal to and be used by children, one of the early questions raised in the requirements period of the project was whether children actually use, and even own,

smartphones.[53] It was the first stumbling block in understanding the requirements of the planned project. Silvester knew the end user would be children in the galleries, but he had the ability to question if the mobile platform for delivering the project would actually be the best option (*ibid*). Access to technology and the use of it is the first step in digital literacy in academic discourse. To assume that children make use of smartphones would support an optimistic view of children as avid technology users and digitally literate. Instead, Silvester's realistic leaning shows a level of consideration about child literacy that is not as evident in earlier projects from WPM. Rowena Hamilton, the former Exhibitions and Display Curator, at the museum, concurred with this understanding and also added that even in 2010 the staff, during a temporary artists' exhibition, felt that 'maybe not quite enough people from our audience had the technology in hand to make [a mobile app], for it not to be a bit exclusive to have augmented reality things within it' (Hamilton, pers. comm. 11 March 2013). Though Hamilton refers to the museum audience as a whole, rather than children specifically, it suggests that she and the rest of the staff understood that even in 2010 audience access and ability to use complex smartphone technology might be lacking.

Silvester created a requirements document and also a simple starting design to work with when tendering out to design companies (*ibid*). The digital trail was aimed at 7-11 year olds visiting WPM 'with parental assistance or independently' (Silvester, 2013). Though the simple brief does not go into further detail about the intentions behind these words, it does seem clear that Silvester acknowledged he understood that not all children in the target age would use the smartphone app trail on their own (Silvester, pers. comm. 11 March 2013). The brief gives several details that the app should 'be part quiz, part interactive, part tour of the museum', which would require a reasonable level of digital literacy by the user to be able to not just operate the smartphone, but also to answer informative questions and understand the historical information presented (Silvester, 2013). By the details presented in the brief, the app does seem to cater to an audience that would be well versed in smartphone technology, including different types of uses such as GPS capability and camera apps and the brief suggests that the way to

[53] Cellphone usage amongst young people is one of the areas that Ofcom has collected data from in the past. Though the take up of cellphone use amongst children is increasing, there is little evidence to show that a wide number of children own a smartphone of their own. However, there is the perception that many adults do and that children visiting with their guardians would be able to make use of a smartphone through borrowing it from an adult.

overcome this is to plan for children to work with their parents to use the application to its fullest.

6.1.3 Assumptions at the Herbert

The renovated Herbert only reopened to the public in 2008, therefore the assumptions staff made in the centre's designs were across the early and mid-2000s. It is difficult within the research to distinguish which assumptions were made earlier in the process and which later, as some of the requirements were discussed starting in 2003, while others were not formulated until 2007 when the majority of the galleries were worked on (see Design Briefs, Roberts, pers. comm. 27 March 2013). However, looking at the design briefs themselves (see Appendix D), it seems clear that the Herbert staff made some assumptions about what type of interactives would appeal to certain audiences, and understood that more text heavy and oral history stations would suit adults, whereas children might be serviced more effectively by some of the simpler and more straightforward (and perhaps enjoyable) digital systems.

One of the unique projects at the Herbert is the on-going engagement with young people from the surrounding community through programmes run by Herbert Media. The programmes engage local youth from a variety of backgrounds and give them skills that may be useful for future careers (Elms, pers. comm. 15 April 2013). One of the courses that Herbert Media has recently run was a photography course and Richard Elms, head of the division, explained that getting young people to take photographs with cameras was simple, but that it is much more difficult to get the participants to take 'a considered photograph' (*ibid*). The central focus of the course is to teach useful skills, through getting the youth to plan, think and consider what they are trying to achieve before they start snapping photos, but Elms has found this to be difficult and a digital literacy skill that needs to be taught (*ibid*). When Herbert Media run digital courses, such as photography or music editing, they tend to make what they do with the young participants as easy as possible, refraining from making the classes too tech-heavy (*ibid*). Both of these comments from Elms suggest that Herbert Media is aware that even young people (older than the target age of museum visitors) are not as digitally literate as public discourse would suggest. Rather, young people do have to be

taught levels of digital literacy and it cannot be assumed that adolescents know how to do everything with technology from the start.

For the audience of younger children, which the Herbert typically designs for, one of the questions that Mel Corner, the Family Learning Officer, has asked is whether children are as adept at new technologies, like iPads, as many people think (Corner, pers. comm. 11 July 2013). Corner has recently raised the argument that designing iPad trails or apps for children may have its problems, as she feels that young children, though exposed to a great deal of technology in their lives, would probably not want to take an iPad or similar device around the museum when they explore, thereby mediating their visit through technology (*ibid*). Corner believes that children would rather view the objects themselves, than use technology to engage with the objects through more in depth information (*ibid*). Whether this understanding of Corner's is an assumption in young children's lack of digital literacy, or more their lack of interest in digital (which does itself lean towards academic, rather than public discourse in digital literacy) is not obvious, but it is clear that the Herbert's Family Learning Officer does not immediately buy-in to the public opinion of children's digital use and literacy skills.

What we have seen in all three museums are examples of interactive creators making a set of cautious assumptions, with varying degrees of confidence, around the requirements of digital media for children. These realistic assumptions are, as we will see in the next section on design, also noticeable in similar ways, specifically in their focus on simplicity in the digital interactive.

6.2 Realistic Discourse at the Design Stage

For the museums in this study, design briefs are usually simple documents that state the user and technical requirements (identified in the first step of the design process) and other concepts, such as learning aims and accompanying information. For the three case studies, there is a range of types of design briefs; where some are more basic (the first initial step), and others are more detailed (the steps before prototyping begin). Documentation for more recent exhibitions is lacking, as the process of design for the museums has changed over fifteen years and often become in-house, meaning that

design briefs that were previously created to put to tender to an external design company are no longer as necessary.

The design documentation that does exist for the NSC, the Herbert and Weston Park comes from their earlier galleries, during redevelopment or initial development (NSC). The design briefs are specific to each interactive planned for each exhibition (though design briefs for non-interactive elements also exist). However, as many of the briefs lack detail, understanding potential assumptions that suggest realistic discourse on child digital literacy is challenging.

6.2.1 Assumptions at the NSC

In the heavily interactive galleries *Exploring the Universe* and *Space Now* at the NSC, the academic discourse of digital literacy about children and adults alike is simplified within the early design briefs. For the interactives in the original briefs, which were first used to list the hoped for inclusions in the galleries, there is a hint at the requirements of the final design. Phrases such as 'easily accessible', 'easily navigated thru' and 'easily absorbed' by visitors are often used in the description section of the interactive brief (Haley Sharpe Design, 2000). This presents the case that visitors, but particularly children over eight, whom these interactives are aimed at, are not able to operate more complex interactive interfaces. In the plethora of briefs in Haley Sharpe Design's archive from the galleries, the interactives aimed at eight year olds and older are ones with layers of factual information, while those whose age range is younger (as low as five years) are more typically fun, game-like interactives (*ibid*).

The key requirement of the National Space Centre was, from the start, scientific education (Yates, pers. comm. 31 January 2013). Over the years, this singular focus has changed somewhat amongst current staff, and there is now more of an understanding that education alone is not enough for the Centre; a visit there must also be enjoyable.[54] Although education and factual knowledge form a part of all the designs the Centre has undertaken since 2001, making exhibits enjoyable or entertaining has taken on a more important role. When *Space Now* was renovated in 2007, the staff wanted to make the

[54] This statement was made by both Law and Mowbray during their interviews. See also the next sentence.

gallery something that would entertain all levels of visitors, but particularly children (Law, pers. comm. 13 February 2013). The old gallery had several design problems with assumptions about digital literacy, particularly in how the interactives assisted the visitor in locating information or correct answers to questions (Parry & Crusciel, 2006: 7). In the redeveloped gallery, the area was layered with information for different ages, allowing for families to make use of the space and enjoy their time there (Parry & Crusciel, 2008: 18). The new gallery therefore could entertain all levels of visitors, as well as provide factual information to those visitors who wished it. The new touchtable in the centre of the entrance gallery provided video and audio for children to, as Graham Law puts it 'bash at it and listen to the sounds' (Law, pers. comm. 13 February 2013). There was little expectation that children would read the text in the new gallery, but that the short videos and the draw of the touch table would at least be interesting enough to entertain young kids while their parents looked around.

The NSC undertook to redevelop part of the *Looking Up* planets gallery in 2013. It was the beginning of a larger redevelopment for the whole Centre that continued in 2014, and will for several more years (Yates, pers. comm. 31 January 2013). The *Looking Up* gallery details the planets, moons and sun of the solar system. The project took six months from the beginning of the requirements phase to completion (Project Observation NSC, 2013). The original gallery about the 'Sun, Earth and Moon' had been very static, consisting of mainly text panels, graphic images and a play area for under-5s, which had no relation to the rest of the exhibition (*ibid*). Figure 6.5 shows one of the many text panels from the old gallery, showing information about the moon.

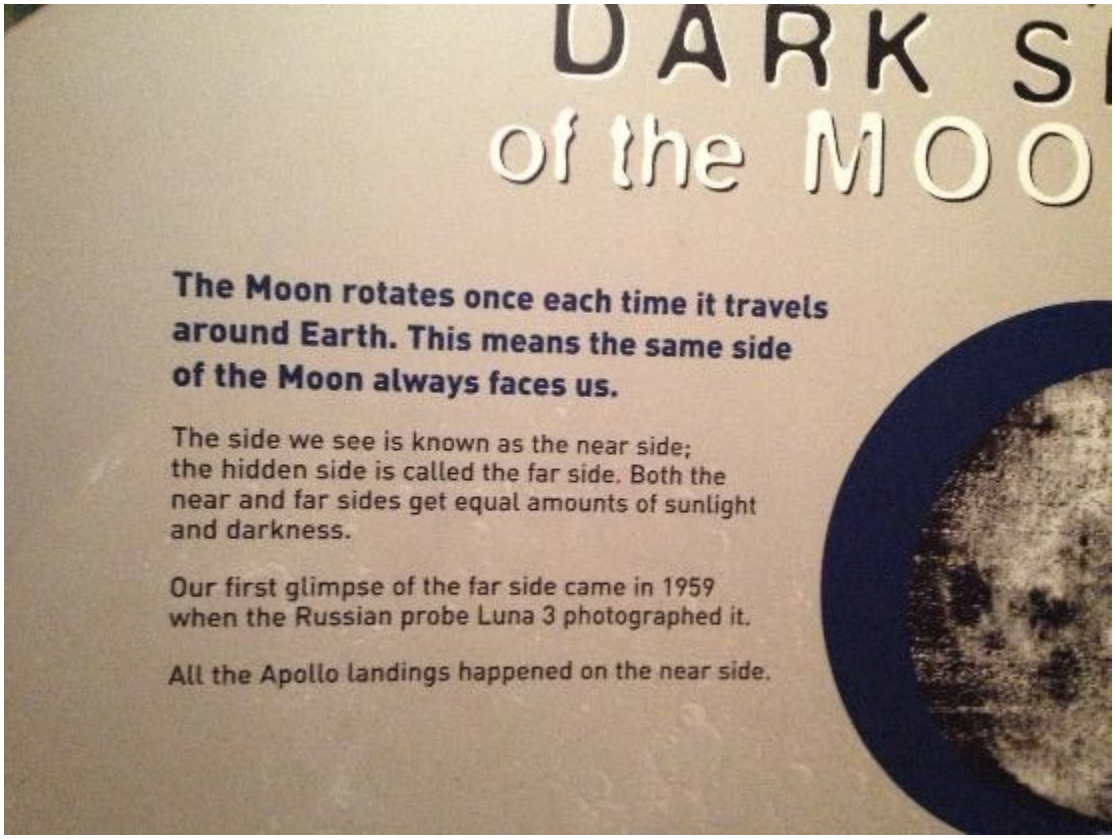

Figure 6.5: Moon text panel, *Looking Up* gallery prior to redevelopment. Image copyright the NSC, reproduced with permission of Kevin Yates.

Requirements for the new gallery were understood to allow for a visiting audience of families with younger children (Yates, pers. comm. 26 April 2013). The gallery was intended to be one that could be updated easily by staff to make certain that the space was changeable and would not become static; as Yates says '[t]he unchangeable bits and pieces can be put in more of a text based thing. But all the other things we'd keep the content digital so it can be updated' (Yates, pers. comm. 2 September 2013). The Google Earth table was also created to be updatable by staff (Howell, Project Meeting #2, NSC). In the design phase of the project staff met regularly to discuss design issues, during which assumptions were raised (Project Observation, 2013). As the gallery was aimed mainly at children and their families, the assumptions were for the most part about popular and optimistic discourses in digital literacy (see Chapter 7), but there were some measured comments that could be viewed as displaying expectations more consistent with the realistic perspective from the staff. These centred specifically on the required inclusion of digital interactives that were readily updatable. Several staff raised the issue over whether children would actually appreciate digital interactives and

understand how to use them properly (in accordance with what the staff hoped visitors would learn and understand in the exhibits) (Shorrock, pers. comm. 11 February 2013; Project Observation, 2013).

During the early design meetings, the project leader raised the issue that digital interactives in the Centre often led to children 'button pushing' (from Yates, pers. comm. 31 January 2013) rather than engaging with the interfaces, and this needed to be avoided when designing for the new gallery (Yates, Project Meeting #2). The interactives were therefore redesigned to be simple and tie in with current levels of visual and digital literacy of most children. The platforms used were similar to smartphone technology and the iconography was kept similar to current available public technology to make it more likely that visitors would understand what they needed to do to operate the interface of the various interactives (Howell, pers. comm. 13 February 2013; Law, pers. comm. 13 February 2013). Text on the interactives was minimal, with staff working from an assumption that children would be less inclined to read; instructions for how to use the interface would need to be simple enough that the interactives would become intuitive (Yates, pers. comm. 31 January 2013; also Yates, pers. comm. 2 September 2013; Gallery critique, 2013; see also Howell on 'SOHO' interactive: Project Meeting #3, NSC). Staff involved in the gallery redevelopment clearly built upon previous knowledge from other design projects for the new interactives.

6.2.2 Assumptions at WPM

The main interactive created for the *What on Earth!* gallery at WPM was designed by staff member Alistair McLean. He created the design brief and the system on which the program ran. The game was aimed at ages eight and over, as was the gallery as a whole (McLean, c. 2005, Designed for Life brief). This shows that McLean assumed that younger children would not be able to use, or at least understand the desired outcomes of the interactive. The complexities in creating an animal for a specific environment, through multiple selection screens and options, rather than simply 'button-pushing' (from Yates, pers. comm. 31 January 2013) would not be possible for children under eight years, without at least adult assistance. The desired learning outcomes of the game were made clear in the design brief, appealing to National Curriculum students over

eight years old (*ibid*). However, even at this older age, the design of the interactive was meant to be 'simple and fun to use', implying that McLean considered how even older children might struggle with a more complex interactive or learning idea (*ibid*). Figure 6.6 demonstrates one of the typical user screens of the interactive, giving choices on the right side for the visitor to pick which will then build the creature in the centre of the window. The easy-to-follow instructions at the bottom provide more detail for those visitors who wish to read, while the central bar with 'rotate' and 'zoom' provide symbolic buttons in order to manipulate the creature design.

Figure 6.6: First screen of the 'Designed for Life' interactive, WPM. Image by author, used with permission of Museums Sheffield.

Originally, there was another interactive meant for the *What on Earth!* gallery that was even simpler and aimed at children younger than eight, both in the interface design as well as the learning objective, which was for children to be able to feed different animals different types of food (McLean, pers. comm. 17 September 2013). This was an underlying theme in 'Designed for Life', though not the main concept (which was

adaptation).

The fun or play element to engage children was also used by Weston Park Museum in their 2011 *Sports Lab* exhibit. The exhibit was designed through the year 2010 (similar to the Herbert project discussed below) and ran for the length of 2011 in the museum's temporary exhibition space. To appeal to the family audience typical of WPM since its redevelopment, the exhibit was created to be an interactive show, as the young girl in Figure 6.7 demonstrates (WPM, 2011).

Figure 6.7: *Sports Lab*, dance interactive, 2010. Image copyright WPM, reproduced with permission of WPM.

There was text as well as objects, but the central parts of the exhibition allowed visitors to move and play.[55] This was through two main digital installations, the first of which allowed visitors to compete in a virtual bike race and the second was an open dance floor for visitors to compete against each other (Gallery Observation, Sports Lab, 2011). Both of these interactives were about having fun and getting moving. The dance floor was particularly important in displaying staff assumptions about digital literacy. It was kept simple, with few instruction to ensure it could be used by a range of visitors

[55] Gallery observation undertaken by researcher during the Sports Lab exhibition at WPM.

with any level of digital literacy (see image above); the activity only required the visitor to follow the movements of a cartoon character on the large screen in front while standing on a specific area of brightly coloured floor (Gallery Observation, 2011). The simplicity ensured that even very young children would have no difficulty using the interactive. It was observed for this project that even very young children made use of the space (see Figure 6.7[56]) during the exhibition run and seemed to enjoy themselves (Gallery observation, 2011). By assuming that not all visitors would be digitally inclined in 2010, staff ensured that the interactive would be usable by all.

6.2.3 Assumptions at the Herbert

For the Herbert's *Coventry Time* interactive, designed for its new history gallery, the idea was to showcase both the museum's watch collection and also provide visitors with a glimpse into the history of local watchmaking practices. Instead of an interactive that provided extra layers of textual information, the staff decided on a system that was very simple and straightforward for users to handle. The game was specifically designed to give users a choice in how they would construct a pocket watch; however it ensured that if the user attempted to assemble the watch in the wrong order, the system would advise them what to do (Herbert, 2007a). The step-by-step process was simple enough that the interactive was accessible for all ages, consisting of only five stages of building the watch, with each stage having only a few choices. The accompanying information for the user was kept very basic, which shows that staff understood that younger users were unlikely to read the information, but would still need to be able to operate the game (Herbert, 2008a). The basic premise of the interactive design allowed for children to use it, while a deeper layer of information tied in with the surrounding display and museum collection was aimed at adults.

This also happened when staff asked the external design company for the redevelopment to create an interactive in the Discover Godiva gallery that allowed families to explore the paintings that would be hung on the walls. The staff at the Herbert created a project brief for the external designers that detailed that the interactive

[56] Also from video footage of exhibition found on the Sports Lab page of Museums Sheffield: http://www.museums-sheffield.org.uk/museums/weston-park/exhibitions/past-exhibitions/sports-lab-the-science-behind-the-medals

was specifically for children, but that it should also contain higher levels of information for adults, specifically text about the works of art (Herbert, 2007c). Both of these types of interactives showed that the staff assumed that adults, as well as children, would make use of the interfaces and that because of this, information and accessibility aimed at different age levels was necessary.

Figure 6.8: *Secret Egypt* on tour at Worchester Museum, 2013. Image by author, used with permission of the Herbert Art Gallery and Museum.[57]

The Secret Egypt exhibition (that continued to travel around the UK after its display in Coventry) contained only one digital interactive. The rest of the exhibit contained hands-on interactives as Figure 6.8 shows. It was a game show style quiz where visitors could uncover the difference between real historical objects and fake modern copies (Elms, pers. comm. 15 April 2013). The game was aimed at a general audience, but it was hoped that children would enjoy playing it, either alone or with family groups, as Elms implies when he discusses how the system was meant to be used with 'teams of two and one would be looking at the real objects and they'd be working together [with the person on the interactive]' (*ibid*). This fit in with the age group for the museum,

[57] The interactive discussed here was not on display at Worchester Museum when the researcher visited. The Herbert could not find a photo of the interactive for use in this thesis.

which was children under the age of adolescents, the main visiting audience for the Herbert. The game used an actor with a script to engage the youthful audience and pictures more than text to appeal to a younger group. The interactive was very simple to handle as a touchscreen interface and the game provided clues as well as the correct answer, and contained only five questions (*ibid*). All of these design elements point to an understanding by Herbert Media, who created the interactive, that children (particularly young ones) would not have the literacy to enjoy a complex interactive with deep levels of information. Rather, the game was fun in order to appeal to them, with very simplistic learning (*ibid*). The language that was used was simplified and kept to a bare minimum so that little reading was required for the actual game, but more information was provided around the interactive (*ibid*).

The realistic perspective of child digital literacy can be found most clearly with Mel Corner, the Family Learning Officer at the Herbert. She has tended to move away from the optimistic view that children are highly digitally literate and instead believes that museums are about physical objects and technology can often be a barrier to engagement with those objects (Corner, pers. comm. 11 July 2013). Physical things; artefacts, discovery trails or handling collections, will dominate over a child's desire to use an iPad, particularly for younger children (*ibid*). From this, Corner also raised the idea that digital, in her opinion, can make imagination a struggle for children as they age; imagination comes through engagement with the physical (*ibid*). It is this expectation that led to the creation of the 'Through the Rabbit Hole' area in the summer of 2013 at the Herbert: a hands-on activity and play space for young children and families with no digital interactives included in the design (Herbert, 2013). This exhibition was followed by 'Adventures in the Lost City', a similar creation in the summer of 2014 (Herbert, 2014). Both exhibits are designed for young children particularly and offer a space to explore imagination through physical interaction with the space, other children and parents (see the exhibit websites). They bring to mind a conjecture, by Corner who created the exhibits, that in order for children to engage and appreciate museums, digital is not the preferred method of design. This does align with realistic discourses in digital literacy, as it stems from the concept that getting children to engage with information presented digitally can be difficult and getting them to understand such information is even more complex.

6.3 Realistic Discourse at the Prototype Stage

The requirements and design stages are the best represented in the data collected for this project. Recalling our discussion in the previous chapter, we note that the last two stages of the standard four-step approach of interactive design are 'prototyping' and 'evaluation'. Strikingly, in both cases, these are markedly less obvious in the project archives of all three museums. Partly this is due to missing documentation, namely from the museum redevelopments and the NSC's creation, but also in part (more recently) to in-house designs where detailed documentation for projects is less well kept or necessary. Staff designing in-house have less need to keep documentation beyond personal email communication and their own notes from project meetings, and that was not the type of data accessible for this research study (see the NSC particularly; Mowbray, pers. comm. 26 February 2013). However, in several unique cases, prototyping documents for projects that have previously been discussed in this chapter were accessible. Documentation is typically very simple computer sketches of interactive interfaces, shown through the various 'screens' that the end user will see (see Figure 5.11) with small amounts of accompanying text explaining the interface.

6.3.1 Assumptions at the NSC

Of the archives kept by Haley Sharpe Design, the company who created the National Space Centre's galleries, only the design briefs, floor plans and photographs of the in-progress and completed galleries exist. As such, prototypes for the early interactives were not available for this study. The only prototype that was available for view for this research was that of the 'SOHO' game interactive in the new 'Sun, Earth and Moon' section of the *Looking Up* gallery, which opened in 2013 (Figure 6.9 displays a model of the game). The interactive was designed to showcase the SOHO model, which hangs from the ceiling of the gallery, by enticing visitors to use a computer version of the satellite to take photographs, as SOHO does in space.

Figure 6.9: Design sketch of 'SOHO' interactive. Image copyright the NSC, reproduced with permission of Darren Clegg, NSC.

The interactive was designed by a website developer (Gareth Howell), an NSC staff member, as part of the gallery redevelopment over the course of the first half of 2013 (Howell, pers. comm. 12 August 2013). The prototype for the interactive was contained on Howell's computer, but was viewable during the research for this study.[58] Howell created a prototype along the design specifications discussed in project meetings, which was then available for project staff to comment on and suggest iterations. The original prototype was very similar to the finished product in the end, though several more revisions were necessary once the interactive was placed in the gallery (Howell, pers. comm. 12 August 2013). Howell specifically prototyped the interactive to be usable by children and to steer it clear of the traditional 'button-pushing' (see Yates) that interactives often evoke, which is something he's seen at other museums. He finds that those types of interactive are:

> creating a kind of false interactivity in a way […] it's like clicking everything and for little kids running around I think that's sort of fine, but

[58] Only to the author as part of the project observation undertaken at the NSC.

> you want it to have some meaning. (Howell, pers. comm. 13 February 2013)

Howell wanted the game to require visitors to pay attention and actually follow instructions in order to achieve a result, which tied in with the model hanging from the ceiling above. The first prototype that was completed had its faults, however, and required a further iteration after it was used by the rest of the project team; the instruction to activate the camera to take a photograph during the game was not obvious enough, so Howell added a green flashing camera button that made it clear to visitors that an action needed to be taken (Howell, pers. comm. 12 August 2013). Observation in the gallery since its opening suggests that visitors, especially children, seem to grasp that the green flashing button needs to be pressed in order to work the game (author).

The assumption that interactives typically lead to children 'button-pushing' (from Yates, pers. comm. 31 January 2013), point towards an understanding of digital literacy that looks more towards the academic (than the popular) discourse, and is what the digital media literacy literature would call more 'realistic' than 'optimistic'. Children cannot readily engage with complex digital systems and need more obvious signposting to direct them, as Howell discovered and corrected for during the last iteration of the prototyping phase.

6.3.2 Assumptions at the Herbert

In 2013, the Herbert began to develop an iPad application aimed at Key Stage 2 (7-11 year olds) to be used specifically as part of school visits (Taylor, pers. comm. 15 April 2013). The project is worth discussion here, however, as it is the only prototyping documentation available for the Herbert since staff created the Coventry Time interactive in 2007 for the history gallery. The intention behind the new iPad trail was deeper engagement between the students and the museum's collections, rather than a desire to tap into the newness or excitement of the technology itself. The Herbert wanted 'to use it really as another layer of interpretation to get the kids to engage more closely with the objects rather than it just being something that seems attractive because it's technology', as the Senior Learning and Inclusion Officer explained (*ibid*). An external design company created the prototype, as it was beyond the skills of Herbert

Media, however the design and prototype were measured against a clear focus by the Herbert's staff of what the interactive should contain. The prototype that was available for the research for this study[59] shows a colourful and very image heavy application with short titles and short object descriptions, and further choice such as a quiz (with a game-like element) and the ability to comment or take photographs of the objects in the museum that the application directs them to (Hartwell and Dean-Corke, 2013). The text, images, and themes in the application are directly related to the Key Stage 2 curriculum, and therefore designed for that age group (Taylor, pers. comm. 15 April 2013). Though at first it may seem that Taylor and her team have made assumptions about the levels of digital literacy in 7-11 year olds that adhere more to optimist discourse, further analysis suggests that they have, in fact, carefully considered how to engage this very specific age group, by appealing to the more competitive aspects of learning and by maintaining an image-heavy and text-light design in the iPad app. As well, having the application as a facilitated educational visit means that adults would be on hand at all times to assist children in the use of the devices and the app and to encourage them to explore the application's capabilities.

6.4 Realistic Discourse at the Evaluate Stage

Evaluation in museums is difficult. This is for a number of reasons, including the limitations that design projects innately have, such as limited time and staff resources, but also because the finance to hire outside evaluators can be resource-heavy. During the research for this project, staff at all three museums stated that they find it difficult to conduct evaluation, except on funded projects where evaluation is part of the project proposal for the involved stakeholders. As Graham Moore at WPM said, 'hopefully you evaluate a little bit, but there's never time to turn around to somebody and say, you know, we haven't quite finished that [project] because everybody's on to the next one' (Moore, pers. comm. 18 April 2013). This makes uncovering digital literacy assumptions in evaluation difficult, as evaluation does not exist for many of the projects discussed in this thesis. As with the prototyping phase there are, however, several situations where the case study museums were able to undertaken some type of evaluation.

[59] This document was not permitted to be included in the Appendices.

6.4.1 Assumptions at the NSC

The Head of NSC Creative considers evaluation a key part of a design project, but understands that it must take place at the right time: too late means that it is difficult to change the design based on the evaluation, however it is difficult to evaluate until there is a working prototype of the digital system (Mowbray, pers. comm. 26 February 2013). At the NSC, the Centre undertakes several types of evaluation, from observation by the floor staff and visitor feedback through to evaluation of projects during their lifecycles and evaluation of the project team (*ibid*). The visitor feedback is quantitative (metric) and less useful to understand what visitors truly think and how they use the digital interactives in the Centre (*ibid*). Attempting a full-scale project evaluation by hiring an outside evaluator appears to also be difficult and currently beyond the resources of the NSC, as it is difficult to find the money to cover the high cost (Yates, pers. comm. 2 September 2013).

For the new 'Sun, Earth and Moon' section of the *Looking Up* gallery, some observation and informal evaluation was completed once the gallery was in place, but before it was fully opened to the public. This allowed for some minor corrections to be made. The Tinytarium, the original under-5s play area that was converted into a small planetarium space, was the focus of the evaluation during the time the gallery was being fitted (Figure 6.10 shows the original under-5s space before redesign).

Figure 6.10: Original Under-5s playroom in *Looking Up*, now the Tinytarium. Image copyright the NSC, reproduced with permission of Kevin Yates, NSC.

Staff attempted to create several different types of content in the space to see which visitors preferred to view (Yates, pers. comm. 2 September 2013; Shorrock, Law, Project Meeting #4, NSC). They discovered that the best use was as a quiet place to sit and reflect and view a projected image of the night sky on the ceiling of the Tinytarium, though this was not the original planned idea for the interactive after opening, which was to be a miniature version of the larger planetarium shows in the Centre's main theatre (Yates, pers. comm. 2 September 2013). The show would display a short film about the solar system's different planets through visitor choice of buttons along the wall of the room, which staff assumed children would enjoy pressing (observation showed this is exactly what children did do), but though children seemed to enjoy this version, adult visitors preferred the night sky projection's quiet contemplation (*ibid*; Gallery Observation, July 2013). The NSC's staff clearly understood their separate audiences, and what appeals to children rather than adults, which was the purpose of the Tinytarium. They knew that button pushing to play the short planet films would be

exactly what children would do upon entering the room and that they would get enjoyment out of this and the films aimed at a younger audience.

6.4.2 Assumptions at WPM

At Weston Park Museum, Learning Manager Laura Travis supervised the early digital trails for visiting school groups starting in 2008. The trails allowed visiting school groups to explore the galleries unassisted using early tablet technology. Though Travis (pers. comm. 8 April 2013) did not conduct any formal evaluation of the programme, she did employ her own information evaluation by observing the children and speaking with the teachers during the project. Travis found in the early days of the programme (2008/2009), that visiting children struggled to use the Word document feature on the digital trail to record their experiences in the gallery (*ibid*). Travis believed that, at the time, the technology was still too new for children to have the digital literacy to operate the system the way staff hoped they would (*ibid*). Although this example does not show realistic discourse in digital literacy in the design and prototyping of the project, it does demonstrate such an understanding in the evaluation Travis undertook, coming to understand that children were not as familiar with technology as it was assumed they would be. This understanding has since shaped more recent projects with children and digital technology, including the 2014 project to institute a new digital gallery trail, which will be available for visiting families (*ibid*; Silvester, pers. comm. 11 March 2013).

6.5 A Continuity of Limited Realistic Discourse

Looking through the prism of media and communication studies, the research question for this study asks, with respect to the production of in-gallery interactives, what assumptions and expectations have been made by regional museums in England around child digital literacy, and whether these assumptions have changed in the fifteen years since the millennium. The realistic discourse used by museums in this chapter suggests that they feel children are unable to understand and engage with information presented digitally without adult assistance; that complex systems may be confusing to children who have never used them before; staff observed that children use digital for simple or fun reasons rather than complex educational reasons; and assume that adults have a

higher level of digital literacy and will therefore prefer digital interactives that involve layered information. This section will present the evidence of assumptions from each of the three museums as a synthesis, to show the understanding of digital literacy across fifteen years of digital design and answer the question of whether those assumptions have changed or evolved.

For Weston Park Museum, the evidence suggests that staff assumptions appear mostly in the requirements and design phases of the projects. For WPM, over the course of the last fifteen years, interactives have been specifically designed for ages eight and up, for the reason that staff assume younger children will struggle to make use of the different types of interactives in the galleries. Staff feel that children often 'button-push' (to employ Yates' wordage) when using interactives, and that this does not accomplish anything other than, perhaps, their enjoyment. Staff hope that children have more engagement than simple enjoyment with the interactives and through them, the collections. When designing digital interactives for over eights, the data collected for this study shows that the staff have focused on making the systems fun and enjoyable, with obvious instructions. More recently, a move has been made to design interactives for the 7-11 age market, but the staff acknowledge that some children will likely need adult assistance to use the interactives in all the ways the new museum trail is designed to be used.

The evidence demonstrates that there has not been a clear change in realistic discourse assumptions at WPM over the years of the collected data. Rather, the understanding that young children will not always make use of interactives in the way the staff wish them to has meant that digital is designed for over eights, and that even then, the digital interfaces are marketed to be simple and understandable. Several of WPM's interactives have been designed with layers of information to appeal to a range of ages, from children through adolescents to adults, and for families to work together with the systems to use them to the full digital potential.

The Herbert originally began its digital interactives with a focus on oral histories, which were aimed at an adult audience. Evidently, it is only with the redevelopment that opened to the public in 2008 that interactives for children have been designed. The staff at the Herbert believe that children are not likely to read text or instructions.

Interactives that staff have produced or designed have been made to be simple and obvious, as well as fun, and to have layers of information to enable them to be used by various ages of visitors. More recently, the Herbert's staff has solidified their understanding of realistic discourse in digital literacy by explaining that children need to be taught higher levels of digital literacy, they do not come to children naturally (see Elms). As such, technology for younger children is difficult and like WPM, the Herbert generally produces digital for slightly older children, while still keeping the systems entertaining and engaging (using audio instructions rather than text, for example). Most recently, Mel Corner, the Family Learning Officer, has suggested that physical interactives are better for children than digital ones, but other staff members have tempered this by saying that digital is fine as long as it appeals to children and there is adult supervision to help with the technology when required.

Though staff assumptions, identified in the data, have become clearer in recent years at the Herbert, the expectation of children's levels of digital literacy and their engagement with technology (being low) has persisted, adhering to realistic understandings. Unlike WPM museum, however, the Herbert is willing to design for a slightly younger audience, with the understanding that digital interactives for younger children need to be for families, with adults there to assist children in getting the most out of the interactive and understanding on a deeper level.

For the National Space Centre, the data collected for this study also displays assumptions in line with realistic discourse of digital literacy in all parts of the design process, from requirements through evaluation. As at WPM and the Herbert, there appears to be little noticeable change in those assumptions over the last fifteen years. The opinions of how children engage with digital interactives come from a variety of staff members. The staff feel that children like to engage in actions such as button-pushing more often than they are able to engage with information presented digitally. Though this is not, on its own, a sign of a lack of digital literacy, it does suggest that a lack of engagement by children could be due to a lack of interest, but also a failure in the design to account for the fact that not all children will gravitate towards digital. This assumption that children will automatically make use of a digital interactive is very optimistic, and something we will explore in further depth in Chapter 7. Staff feel that interactives need to be layered to have simpler and more interesting aspects for

children, in an attempt to get them to engage with the exhibit, rather than simply button push, while leaving information for adults to read and enjoy, such as the touchtable in the *Space Now* gallery.

Since the Centre's staff have taken on their own designs a decade ago, they have made it clear that digital interactives should have a fun element so that children do not perceive them as a learning or educational resource and will be more likely to use them. Interactives that use graphics and video are better than interactives that rely on text to convey their meaning, simply because the staff feel that children will not read text even when presented digitally. For the NSC, the most important aspect of designing digital interactives for children, however, is to keep them simple and enjoyable; for the Centre, complex interactives are not seen to be understandable and therefore are not enjoyable.

More recently, the evidence shows that there has been a move towards designing more interactives for the galleries than in earlier eras, and from this staff have not steered away from more complex games and systems, but designed them to be as simple as possible to use, while giving visitors clues to how they operate. For the new 'Sun, Earth and Moon' section of *Looking Up*, this has meant that visitors are now shown how to use the interactives through employing the use of symbols, colours or flashing lights to draw visitors' attention. These subtle cues require no reading. The staff have felt children will be able to engage with such interactive systems, even if they still do so via what Yates sees as the pushing of buttons, they will at least have an enjoyable experience. Observation in the gallery by staff and during the data collection for this research project suggests that children do seem to understand how to use the interactives with little assistance required by adults. On the other hand, the galleries have, from their inceptions, been designed for families to use and design staff at the Centre understood that adults would always be on hand to assist children when their digital literacy skills may be lacking.

6.6 Conclusion

In all, we have surveyed the institutional archives and project documentation for design work over the last fifteen years at these three institutions, and having interviewed staff involved in many of the exhibits, there have, significantly, been no noticeable changes

in the realistic discourse within these museums. Furthermore, this body of evidence suggests that very similar assumptions have been made amongst the staff at the three case study museums. This is significant, because the evidence suggests that staff who are making realistic discourse based assumptions are doing so from a wider understanding of the debates surrounding child digital literacy, rather than upon their own personal estimations. The focus on designing digital interactives that are for slightly older children suggests designing the interface to be as simple and easy to understand as possible, with the knowledge that most children will engage with the digital systems with adult supervision or assistance. The staff at the NSC, the Herbert and WPM clearly understand this concept. The realistic digital literacy discourse agrees with these understandings, purporting that children need to be taught digital literacy, and therefore older children will have had more time to become digitally literate, but may still need assistance to engage with digital systems in complex ways or to acquire complex information. The digital interactives at the case study museums are kept simple, appealing to a sense of fun and exploration, rather than focusing on understanding important facts or themes that could be too complex for children to grasp without high levels of adult assistance. The entirety of realistic discourse in digital literacy is not obvious in the museum institutions presented here, but certain aspects of the discourse are, suggesting that perhaps those aspects are more accessible to a general populace (both the public and museum professionals).

These conclusions then gain other significance when seen in the context of the conclusion of our next discussion – on the evidence for optimistic discourse in these same projects in these same museums. As Chapter 7 will show, there is a clear contrast between these realistic based assumptions, in this chapter, and the optimistic ones, in the next. As well, it is often the same staff members that have made both realistic and optimistic discourse assumptions around digital literacy in children. The realistic discourse assumptions have ensured that digital interactives have been designed to be simple, easy to use and to appeal to children. As Chapter 7 will discuss, even with these basic requirements, assumptions in line with popular and optimistic discourses in digital literacy can have a large impact on digital interactives and museums' interactive strategies.

Chapter 7: Optimistic Discourse on Child Digital Literacy within Interactive Design

7.0 Introduction

Chapter 6 has identified and examined the digital literacy assumptions about children by staff at the case study museums, which relate to realistic discourse. The chapter did this by disaggregating projects using the four-step design process, and detailing where and how staff involved with digital interactive designs at each stage of the project made those assumptions. This chapter continues that same structure, but instead moves into the realm of the optimistic view and belief about child digital literacy – identified in Chapter 3. Many of the projects discussed in the previous chapter will be examined again, as both academic and popular assumptions were made during the course of the projects' life cycles. However, several new projects will also be introduced.

This penultimate chapter will draw together all four previous chapters, building upon discussions of digital literacy and user-centred design processes that set the stage for the main focus of this study in its research question: what assumptions have museums made about child digital literacy using in-gallery digital interactives and what has changed in these assumptions over time? We have already seen how there has been little change in assumptions across the three case study museums (and within them) in their academic and realistic discourses about child digital literacy. We have also seen how this has continued to influence the design of digital interactives in the galleries over the course of fifteen years. This chapter will contrast those assumptions with ones in the public realm. In the last section prior to the conclusion, we will discuss the issue of the perceived lack of changes over time in a range of the popular digital literacy discourse, (similar to what we discussed in Chapter 6), as well as the gradual and smaller changes within individual institutions that are more difficult to understand.

7.1 Optimistic Discourse at the Requirements Stage

We have already familiarised ourselves with the requirements stage, the first step in the design model advocated by Rogers, Sharpe and Preece (2011). It is, for museums, a

very important to step in understanding the end user (the visitor) for whom the digital interactive is being created. In the case of this study, the focus of the end user is on the younger generation, children.[60]

7.1.1 Assumptions at WPM

The redeveloped Weston Park Museum that stands in Sheffield today could not be further removed from the glass-cased traditional exhibition style of its former incarnation (see Figure 7.1 and 7.2).

Figure 7.1: Original 19th century gallery of the City Museum and Mappin Art Gallery, which stood on the site prior to the creation of Weston Park Museum. Image copyright of Museums Sheffield, reproduced with permission of Museums Sheffield.

[60] It should be remembered that although this study deals with the term 'post-Millennials', it is not this generation alone that is characterised in Chapters 6 and 7. 'Post-Millennials' is the term for only the recent generation of children. Interactive designs from a decade ago would have been created for the generation of 'Millennials'.

Figure 7.2: Pre-2000 Natural History gallery, WPM. Image copyright Museums Sheffield, reproduced with permission of Museums Sheffield.

When WPM was redeveloped, it was commented that the fixity of the old galleries was left aside and because of this 'there are high levels of interactivity, digital or otherwise, throughout the museum' when it reopened in 2006 (Hamilton, pers. comm. 11 March 2013). This was carried out in order to engage a more family audience for the redeveloped centre. In Museum Sheffield's Interactive Strategy (see Section 6.1.2), interactives are seen as 'self-perpetuating, as they are now an accepted part of museum design' and necessary in order to ensure visitors are not disappointed (2006). At the same time of the redevelopment, Museum Sheffield's Learning Manager felt that there was, amongst the design and staff teams at WPM a sense of 'we have to do digital' because 'I think people expect it' (Travis, pers. comm. 8 April 2013). Travis *(ibid)* was specifically referencing children and went on to emphasise 'I think children […] expect a lot' while speaking about the creation of the new galleries between 2003 to 2006. The notion that interactivity and family audience are characteristics of a museum that must go hand in hand is clear from both Hamilton and Travis' comments. That these relate to optimistic discourse of digital literacy may seem less clear, but we should remember that part of the popular discourse discussed in Chapter 3 explains the assumption that children enjoy digital technologies and – even – need such options in their daily lives in order to enjoy themselves.

Staff, according to the Visitor Engagement Manager, had assumed that there would be many conversations amongst multi-generational groups visiting the new galleries; that adults and children would interact and enjoy the visit together through discussion (Travis, pers. comm. 8 April 2013). This assumption was, however, not played out after the museum reopened, Travis went on to state.[61] Instead, they found that children visiting were entertained and that parents were left to reflect more quietly on their visit and that only later – at home – did families engage in conversation of their 'shared experience' (*ibid*). The assumption that children would be able to engage with adults during their experience, and would be able to share the interactivity with visiting guardians in an articulated way, shows a decidedly optimistic view of child digital literacy abilities, particularly at the Key Stage 2 age the galleries were aimed at (Hamilton, pers. comm. 11 March 2013). This lack of engagement may also be due to subject matter of the new galleries. However, staff hoped that the subjects would be of interest between groups and that the interactives would allow for the generations to discuss questions and images presented digitally. Though lack of interest can be one reason for this, the inability of visitors (particularly children) to access and understand the interactives is another reason.

More recently for WPM, after the centre reopened with its new galleries, a digital based school trail was created for visiting students to tour the galleries without the assistance of museum staff. In order to make the trail available to students in the years prior to iPad technology becoming available in museums, Ultra Mobile PCs were purchased. It was hoped that the digital trail would replace the more common paper trail available for schools (Figure 7.3 below).

[61] The galleries are set up to encourage inter-generational discussions, by asking questions of visitors, reflecting on past experiences and by interactives in which adults and children can interact together. These were noted by the researcher during gallery observations in 2013 at WPM.

Figure 7.3: First part of the paper-based school trails at WPM. Available online for teachers at: http://www.museums-sheffield.org.uk/assets/PDFs/Ancient%20Egypt%20school%20trail.pdf Image removed due to copyright restrictions.

Travis (pers. comm. 8 April 2013) was open in her reflection of the project, explaining that staff had hoped that children would use the accompanying inbuilt Word application to record their experiences and learning while doing the trail. However, it was found that children, at least in the first year after the trail launched, struggled to make use of this particular feature during their tours. This assumption shows that one of the basic requirements of the digital interactive trail was based on pretext that children's ability to make use of Word processing applications and also to record information digitally would not be an issue for visiting Year 6 students (*ibid*). The only image of the trail (no longer used) that could be found for this research shows a colourful quiz-like screen (Figure 7.4).

Figure 7.4: This trail is concerned with Animal Adaptation. Image from this site: https://ssclc.wordpress.com/tag/mobile-learning/ on the Sheffield South City Learning Centres blog 15 October 2008. Image removed due to copyright restrictions.

Staff made the assumption, when undertaking the original requirements steps for the digital interactive, that children's digital ability to record information as well as use Microsoft-based applications would not be an obvious issue in 2007. This example serves to demonstrate that the optimistic discourse in digital literacy, which is in many ways opposite of those of the realistic debate from Chapter 6, can be just as clearly uncovered in the design projects.

The WPM school trail was replaced in 2013 and 2014, and comments by the Learning Manager about the new trail suggest that children are becoming more digitally literate: 'they were behind, then they could do it, and now that's behind what they can do' (Travis, pers. comm. 8 April 2013). Children struggled with the technology in 2007, then came a period of time when it appeared to staff that children could use the technology more competently, and now Travis believes that the technology of the school trail is easy for children, or rather, that children are able to do much more with technology than just record their learning in a Microsoft Word application on a mobile trail. A continuation of the assumption of children's skills when it comes to digital interactives has perpetuated, at least to Travis. Travis also commented personally that she had friends with young children who appeared to 'instinctively' know how to use new technology (*ibid*). This refrain, characteristic of optimistic discourses identified in Chapter 3, can be found in WPM and amongst the staff even in 2013 and suggest some

inherent assumptions constructing children as some type of technology savants, who need no instruction of how to use digital. Travis did caution in her approach by saying of current children, the post-Millennials, that '[y]ou'll always get some children that are way ahead of you and some people that…for whatever reasons, haven't seen that technology yet' (*ibid*). The fact that, in the mind of Museums Sheffield's Learning Manager, 'children' specifically can be ahead in their technology use demonstrates an opinion of child digital literacy that heavily slants towards the optimistic side of the debate.

7.1.2 Assumptions at the NSC

We have discussed in Chapters 5 and 6 how the NSC is different from WPM and the Herbert, both in its subject matter as well as the fact that it was a new institution in 2001. A press release from a decade after the Centre's opening characterised it as an educational institution that was highly interactive, specifically in the *Into Space* gallery which had 'the most "hands-on" interactives' and *Space Now* which was 'the most high-tech area of the centre' overall (NSC, c. 2009). From the very beginning of the initial requirements phase of design in the 1990s, the NSC was intended to be a Centre for child visitors, to serve them educationally and 'excite the new generation' (Yates, pers. comm. 31 January 2013). Included within this was the move towards heavily interactive galleries, owing to the fact that '[i]n the 1990s, the touch-screen was white man's magic' and technology was therefore expected to be used in the new Centre (Law, pers. comm. 13 February 2013). Law supposed, looking back, that the added addition of the technology to the new Centre drove the 'geeky attraction that some kids might have' and was therefore popular and could serve to replace real models, where real models of space exploration could not be had in the Centre (*ibid*).

The original *Space Now* gallery was highly interactive even before the redevelopment in 2008. Parry and Crusciel's work in 2006 found that the interactives were 'more likely to stimulate interaction' amongst visitors and that the Galileo touchscreen was particularly 'popular and highly engaging' (2006: 16). The report went on to further state that 'some visitors (especially children) appeared to expect the screen to function as a touchscreen […] but then move on when the screen does not respond' (*ibid*). The original design of the *Space Now* gallery as it was in 2001 had expectations of levels of

visitor's digital literacy, particularly the children. The requirements for the gallery would have been to market it to children of Key Stage 2 age (as the rest of the Centre was) and to make it educational and interesting for them. The introduction of interactive technology was expected to accomplish this, and indeed was seen in the popularity of the interactives. However, we must remember that popularity does not constitute understanding of the technology or the intention of the interactive by its designers, and it is just as likely that 'popular' meant that children enjoyed playing with the interactives, rather than learning or increasing their literacy skills. Indeed, the later 2008 report after the gallery was redeveloped stated that 'visitors continue to spend most of their time with the digital media elements of the gallery' (Parry and Crusciel: 12). However, more recent gallery observation (five years on from the report) of visitors suggests that few children engage with the interactives fully, and mostly hit or press at buttons on the exhibit and seem unsure of how the projector-enable *Space Now* table actually works, as they treat it as a touchscreen when it operates by sensing movement instead. Indeed, Law (pers. comm. 13 February 2013) agrees with this observation, specifically regarding the *Space Now* interactives that were designed, using entertainment principles, for the children to enjoy, though he feels that perhaps older children and adults in fact also received a measure of learning from the interactives. Charlotte Isham (pers. comm. 25 February 2013), Education Officer for the Centre, agrees, understanding that children like the *Space Now* table because 'they can swipe their hands over the area. I don't know how much all the kids read'. Younger children to the *Space Now* gallery were, however, left out of the original requirements of the design (see HSD Design Briefs), which has created difficulties with current visitors and therefore with lower levels of digital literacy to operate the interactives.[62]

During the observation of design meetings that were conducted in 2013, for the NSC's redevelopment of the 'Sun, Earth and Moon' section of the *Looking Up* gallery, it was found that children did not feature as prominently in the requirements phase as expected. Though the gallery was designed for children ages eight to slightly older (to fit in with the current audience at the NSC), visitors were viewed rather as a general whole, rather than specifically broken down into age categories, therefore little mention was made of the differences in abilities with technology between children and adults.

[62] The younger age of the typical visitor at the NSC being below Key Stage 2 is from Yates, pers comm. 31 January 2013.

Expectations were made about the ‘Google Earth’ table in the gallery and about the ‘SOHO’ interactive specifically.

Figure 7.5: ‘Google Earth’ table in situ, July 2013. Image by author, used with permission of NSC.

For ‘Google Earth’, staff assumed that ‘everyone’s got Google Earth. The first thing they do is go to their house’ and therefore there was a need to make the interactive

interesting and different to excite visitors (Clegg, Project Meeting # 2). Though as Figure 7.5 displays, the final interactive looks very similar to a desktop version of Google Earth, however the symbol key is noticeably different. Within 'SOHO', Law pointed out that it needed to be highly interactive for children to pay attention, and Howell felt that a game-like program such as on an iPhone would interest visitors and be simple enough they would easily figure out the solution to the puzzle and therefore would be unlikely to dwell too long at the interactive (Project Meeting #3).

In other words, high expectations of visitors' (specifically the target audience of children) abilities to use a range of technology were to be found in the requirements phase (as well as later design) of the interactives for *Looking Up*'s redevelopment. The digital literacy assumptions will be more obvious in 7.4 of this chapter where the evaluation of the gallery is discussed. The design staff on the project have made obvious assumptions that children would have similar digital literacy levels to adults, and that technology such as the iPhone and Google Earth would be apparently within their understanding. These are clear optimistic discourse-based views of child digital literacy.

7.1.3 Assumptions at the Herbert

The *Discover Godiva* gallery, designed as part of the Herbert's redevelopment, which opened in 2008, was created for families, as the staff at the museum state (Roberts, pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013). Because of this focus on families, particularly with younger children, Keeper of Collections Huw Jones has advised that there was likely a desire by design staff to 'think up as many interactives as we can for [it]' (Jones, pers. comm. 27 March 2013). However, fellow staff member and Senior Curator Martin Roberts cautioned that the entire museum was not like this during the redevelopment, and that Godiva was singularly unique because of its focus as a discovery gallery for children (Roberts, pers. comm. 27 March 2013). One of the several interactive stations in *Discover Godiva* is show in Figure 7.6.

Figure 7.6: *Discover Godiva* reading corner with digital/physical book interactive. Image by author, used with permission of the Herbert Art Gallery and Museum.

Roberts' opinion is weighed out in the rest of the centre, particularly in the art gallery, which is 'not one [of the] most attractive to families' (*ibid*). And in the rest of the more historical oriented galleries the interactives are more akin to inter-generational conversation starters, like the rationing interactive in the main history gallery where it was the Herbert staff's thinking that 'it would be one of these ways where…a game children could play […] where, with luck, grandparents who actually went through rationing can work with children to tell them…' (Roberts, pers. comm. 27 March 2013). Figure 7.7 shows the rationing game in the history gallery, where it was hoped grandparents and grandchild could work together.

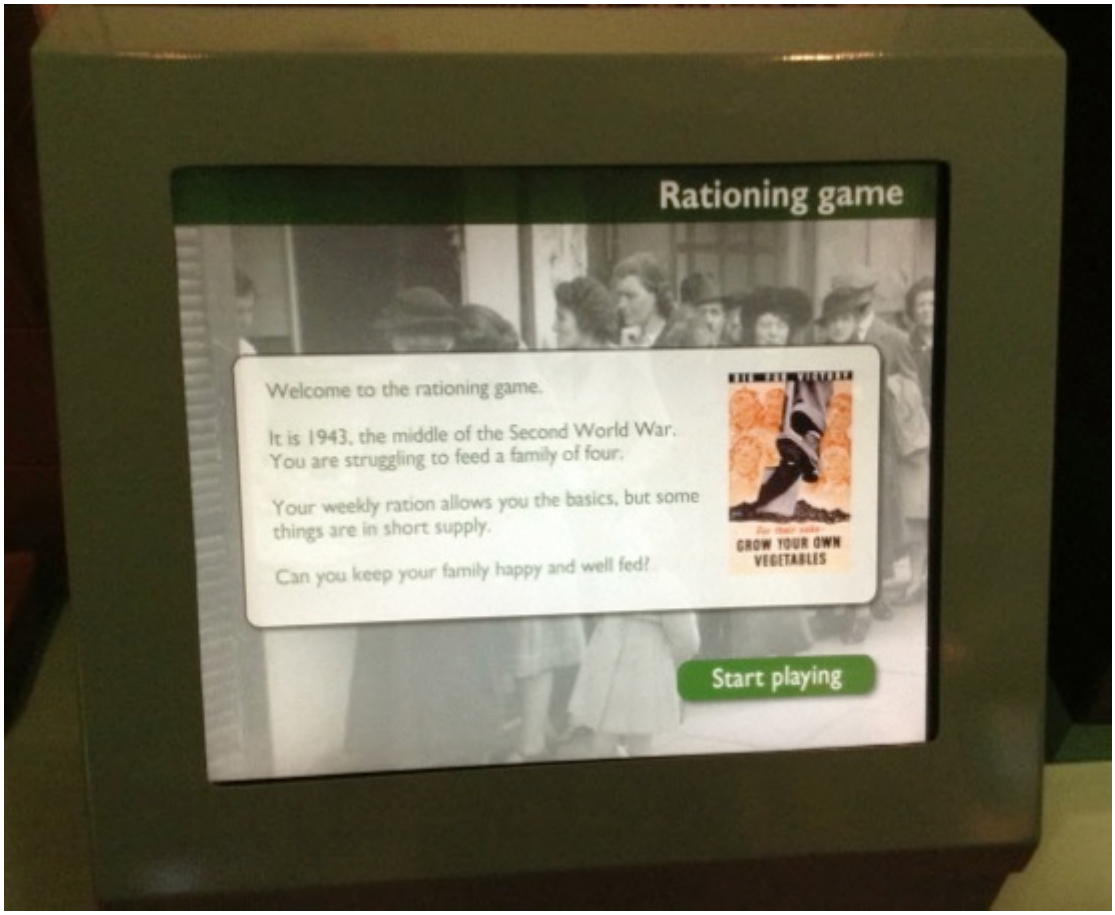

Figure 7.7: Rationing game main screen in *History Gallery* at the Herbert. Image by author, used with permission of the Herbert Art Gallery & Museum.

This desire by the Herbert's staff, who were heavily involved in the redesign along with external designers (see Chapter 5), not to have interactivity overwhelm the gallery spaces could showcase an realistic discourse in digital literacy. However, the fact that *Discover Godiva*, specifically aimed at children, was purposely designed to be interactive, shows that staff did surmise that interactivity would attract or interest children, in opposition to more static displays in the history and art galleries. Optimist discourse, seen above at WPM, indicates that children need digital interactives to be interested or that children expect digital interactives.

Secret Egypt was an exhibition created by the Herbert in 2010. It was predominately a static gallery of objects and text panels, with some physical interactives aimed at children (Figure 7.8 shows the static areas of the exhibit).[63] However, one aspect of the otherwise traditional and heavily text-focused exhibit was a quiz interactive designed

[63] This was observed at the Worchester Museum display of the travelling *Secret Egypt* exhibition by the researcher during field research in 2013.

by Richard Elms and his team in the Herbert Media department (Elms, pers. comm. 15 April 2013).

Figure 7.8: *Secret Egypt* touring exhibition at Worchester Museum, from the Herbert, 2013. Showing object and image-heavy set-up. Image by author, used with permission of the Herbert Art Gallery and Museum.

The interactive was not specifically designed for children, being modelled on a pub quiz machine and, consequently, using a visual metaphor that would register much more with adults. And yet, within this we might perceive traces of the optimistic discourse view of child digital literacy. After all, the exhibition was aimed at a general audience that would include many children, and indeed several of the areas of the gallery were designed to appeal to children, with dressing up sections and an area to create music with instruments in a corner of the floor. Herbert Media would have understood that children would make use of the interactive as well. Indeed, from the previous designs and the redevelopment of the Herbert as a museum, all of the interactives were aimed at children or children with adults: 'I can't think of a single […] digital interactive which an adult wouldn't get something out of as much as a child' (Roberts, pers. comm. 27 March 2013). It is unlikely that the aim of the *Secret*

Egypt interactive would have been different, considering the Herbert's family audience. As such, for Herbert Media, there was an assumption that children would know how to use and understand the lesson in the pub quiz like game (a 'game show' Elms called it when describing the interactive). The game itself had a great deal of learning in it, to explain the accompanying exhibit section on the real and fake Egyptian antiquities markets (Elms, pers. comm. 15 April 2013).

The new Herbert iPad trail, discussed in Chapter 6, is the most recent of the Herbert's development projects in digital interactives. The interactive replaces the traditional paper worksheets for Key Stage 2 school visits. Alison Taylor (pers. comm. 15 April 2013) – Senior Learning and Inclusion Officer – reviewing the reasons that technology was chosen in this instance suggested that iPads offered a chance for new layers of interpretation of the objects. The decision to purchase the iPads in 2012 as part of the funding of a three year development project for schools was due to the fact that the Herbert staff believed that technology was becoming so general in schools and the home and for children 'it'll just be normal everyday stuff' (*ibid*).

However, Taylor believes that the main argument against introducing technology as a means to interpret the collections is an adult issue and 'it's probably adults that see it as a problem that kids might get so focused on the technology that they miss the message' the museum is attempting to convey (Taylor, pers. comm. 15 April 2013). Here, Taylor reports an assumption that 'adults', though she does not refer to precisely which adults, sometimes fear that technology is a barrier to children learning and perhaps that children are too likely to use technology for fun rather than what they are actually required to do during a museum visit. Interestingly, the key part of Taylor's statement is that she sides with the children, and seems to have no fear that children will misuse the technology (at least at Key Stage 2 ages) 'because, you know, they're digital natives aren't they?' (*ibid*). Taylor believes that the Herbert is following the practice of other museums, including the Victoria and Albert Museum in London that have adopted similar technology for mediated visits and that such experiences are becoming more common, making the 'old fashioned worksheet […] look precisely that, old fashioned and quite limited' (*ibid*). One of the main requirements staff identified with the technology, along with the expectation that children would take to the iPads and use them as staff desired (as well as the fact that children are accustomed to technology in

their daily lives) is that the iPad trails would be updatable and adaptable to the National Curriculum and therefore perpetuate into the future (*ibid*). Though the iPad trail was still in early development during the field work for this project, issues about children's ability to use the technology (as WPM found) had not been raised, indeed the expectation that Key Stage 2 children would adopt the iPad trail easily was implied during discussions with the Herbert's staff.

7.2 Optimistic Discourse at the Design Stage

From the requirements stage of identifying the user and their needs, as well as the purpose of the interactive, the design process moves onto the next step (see the introduction to 6.2 in Chapter 6). In this second step the evidence is found in documentation (the institutional archives and sources related to each of the museums' projects) as much as it is in the series of individual interviews conducted for this research with members of staff involved in these developments. As such, the distribution of evidence across the three museums is weighted more towards the NSC, for which more complete and detailed design documentation was uncovered. However, as with realistic understandings found in the previous chapter, WPM and the Herbert are not exempt from this section, despite more limited data.

7.2.1 Assumptions at WPM

In Weston Park Museum, the most obvious interactive to discuss is the 'Designed for Life' activity in the *What on Earth!* gallery. This particular interactive was, at the time of WPM's redevelopment, the most highly technical available in the gallery, and also one that was designed by a Museums Sheffield staff member, rather than one that was left to the external contractors. As such, we can look at the assumptions in this interactive in more detail. Within the design of 'Designed for Life', the main intention was for children to make use of the digital activity while having a conversation about it with their parents (McLean, pers. comm. 17 September 2013). The target audience was eight years and older, though Moore (pers. comm. 18 April 2013), the museum's Children and Young People Coordinator, feels the interactive is just as popular with children under the age of eight. Moore, speaking about his own children, implied that '[m]y kids that are now ten and fourteen have plenty of entertainment out of that thing

almost from the day it started. Almost from the day I started working here it was open and so as young children they came and used the interactive' (*ibid*). Assumptions about the levels of digital literacy would have therefore been made for older children, rather than the younger children that Moore reports have used the digital interactive (and that were observed using the interactive during field work in 2013). McLean (pers. comm. 17 September 2013) states that the main purpose, beyond the message of animal adaptation, was to get 'people to communicate with each other in a group'. Mainly through encouraging within the interactive the engagement of children using it who would then ask the adult members of their visiting group questions regarding the activity. Answers to common questions for the adults could be found in the text in the rest of the exhibit (*ibid*). This implies that the intention was for children to make use of the interactive while their parents viewed the rest of the exhibition, and therefore children would have made use of the touchscreen enabled game on their own. This shows an assumption of a high level of digital literacy in children, both with the expectation that in the mid-2000s children as young as eight would be able to control a complex touch screen interactive as well as to understand what they were doing enough so as to ask questions of their guardians (and, likewise, that adults would be able to uncover the answers from the accompanying text). Though the 'Designed for Life' interactive can certainly be used for entertainment purposes (as was often observed during field work for this project) the underlying educational value of the programme to show animal adaptation through a complex series of screens, enabling visitors to design a creature to survive in a specific habitat, shows that it was hoped that some visitors would understand a deeper level of meaning while creating their creature. Indeed, the main learning objective in the design brief was to understand that 'creatures are adapted to fit the environment they live in' and that 'changes in the environment can cause extinction' (McLean, c. 2005). Though McLean expected adult visitors to be mainly responsible for explaining in understandable terms the process of adaptation, the design brief shows that some measure of understanding through an advanced level of digital literacy was expected of the children using the interactive as well (though perhaps older children could be implied here).

We have already noted in Chapter 6 the temporary *Sports Lab* exhibition at WPM, and the traces within its design assumptions around realistic discourses of digital literacy. However, it is interesting to note there are also some contrasting popular and optimistic

discourses for the same exhibition – a reminder of the sometimes complex ways that mixed expectations can inform the design process. Figure 7.9 demonstrates the type of design in the exhibition, but one of several interactives can be seen on the far right.

Figure 7.9: *Sports Lab* exhibition, 2011. Image copyright of Museums Sheffield, reproduced with permission of Lucy Cooper.

Within the *Sports Lab* exhibition there was an interactive that allowed visitors to design an athlete, 'exploring which physical traits suit particular sporting activities' (quote from Huggett, 2011; Hamilton, pers. comm. 11 March 2013). Unlike the dance floor, which required only a visual ability to follow the movements of a character on screen, and the bike racing interactive, which involved only the ability to ride a bike, the 'Design an Athlete' suggested that visitors would require a higher level of digital literacy.

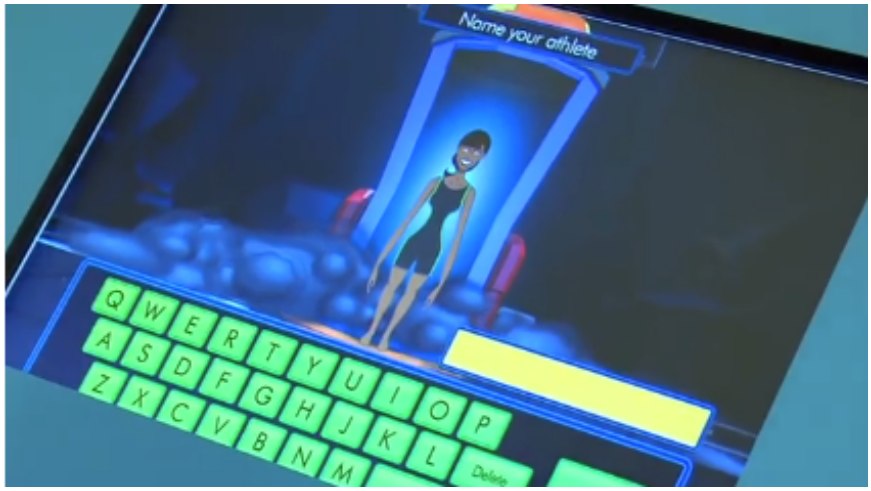

Figure 7.10: Close up on the 'Design an Athlete' computer screen. Image by author, used with permission of Museums Sheffield.

This is because it was a more traditional digital interactive screen requiring visitors to select options, unlike the other interactives in the gallery space which required very little digital knowledge by visitors to use (the dance floor, for example, operated of its own initiative and visitors could enter or leave the space, participate or watch a dance, as they desired). 'Design an Athlete' (Figure 7.10) required the visitor to understand touch screens, the ability to read accompanying text that explained the interactive and to follow digital instructions, while ultimately understanding the purpose of the interactive (to design an athlete for a particularly sporting competition – much like the animal adaptation idea in 'Designed for Life'). Visitors would have required good digital literacy skills to use this interactive the way in which it was intended, particularly when used by children.[64]

In 2013, Museums Sheffield put on an exhibition in their temporary gallery on the subject of Japanese enamels. 'The challenge was to introduce interactivity for children into the exhibition', which manifested itself as a physical interactive, rather than a digital one (Hamilton, pers. comm. 11 March 2013). The digital placed in the exhibition was targeted more at adult visitors through videos, however, Hamilton believed that it would also be 'reasonably engaging for younger visitors as well' (*ibid*). Travis (pers. comm. 8 April 2013) worried that sometimes adult visitors view the redeveloped

[64] During observation of this exhibition, it was noted that this particular interactive was rarely in use, compared with the dance floor or the bike interactive. This does suggest that visitors were either uninterested or did not grasp the reasons behind the interactive in relation to the exhibition.

museum as a 'children's playground'. The attempt with Japanese enamels was to draw adults back into the centre, however in a museum for families it also needed to appeal to children, hence the use of physical interactives – such as dressing up. Staff at Museums Sheffield assumed that the only way to engage children was to use interactivity, and that children would not find the static display cases and text panels in the galleries of interest. The suggestion that there is an assumption regarding the need for digital interactives in order for children to experience an exhibition or enjoy their time would align with more popular and optimistic discourse assumption about child digital literacy, specifically in child reliance on digital in their daily lives.

7.2.2 Assumptions at the NSC

When the Space Centre opened in 2001 it sat as an example of the height of technological availability at the time, through its interactives and especially the wide use of plasma screens (Shorrock, pers. comm. 11 February 2013). At the time, that technology would have been considered cutting edge to the average visitor, however a decade later, plasma screens are commonly found in many homes. Going forward into the future now, the NSC has looked back to reflect on that sharp change and to realise that, continuing on their designs must attempt to offer new technologies, rather than 'replicating what you can do at home' (*ibid*). This has characterised the design of the NSC's galleries from the beginning, even in the hands of Haley Sharpe Design in the 1990s.

Of the five main galleries on the ground floor of the Centre, all contained interactives, both digital and physical (Haley Sharpe Design, Design Briefs, 1999-2000). As we have seen in the requirements section, the NSC was targeted at visiting Key Stage 2 age groups, implying that the interactives were also designed for this same group of children. There was a wide range of interactives, from web terminal stations through game-like interactives and also plasma screens that delivered information digitally, but required no audience interaction (bare reading).[65] The design briefs that were kept in Haley Sharpe's archives are only the initial step in the design process, based on the requirements identified by HSD and their client. As such, they are not detailed, though

[65] Example: *Space Now* 'Mission Timeline – Departure Board' showing upcoming missions to space on a plasma screen.

later design briefs with specifics regarding the interactives and prototypes would have come later.[66] However, from these early briefs, the wealth of digital interactives suggests assumptions about the appeal of such technology to the public, particularly to children, and to the supposition that children would be engaged and educated by such additions to the gallery (versus text panels and objects). However, the number of digital interactives in the Centre as a whole is similar to the number of physical interactives, showing that there was an attempt to balance digital and physical opportunities for visitors, thereby catering to a wide variety of visitors and learning styles.[67]

Within the design briefs, interactives were aimed at certain ages. Nearly all were for 8-14 years and up (including adults), but many interactives were also for 5-8 year olds (which is the age group that the NSC typically receives now). Some interactives, such as the 'Destruction of the Dinosaurs' game (Figure 7.11), were intended that even pre-school children would be able to use them.[68]

[66] These later briefs are only attested by HSD and within the early briefs themselves. No record of the later designs are kept by HSD, nor by the NSC, despite research into the matter.
[67] Likely the reason for the inclusion of physical interactives in nearly equal numbers to digital was the budget. Several design briefs from late 2000 exist which show a decrease in the number of digital interactives planned for the galleries, and some digital interactives ended up downgraded to physical ones.
[68] This interactive was in the *Looking Up* gallery. It was originally two interactives, one letting visitors destroy the Earth by meteorite, the other about what size of meteor might have wiped out the dinosaurs.

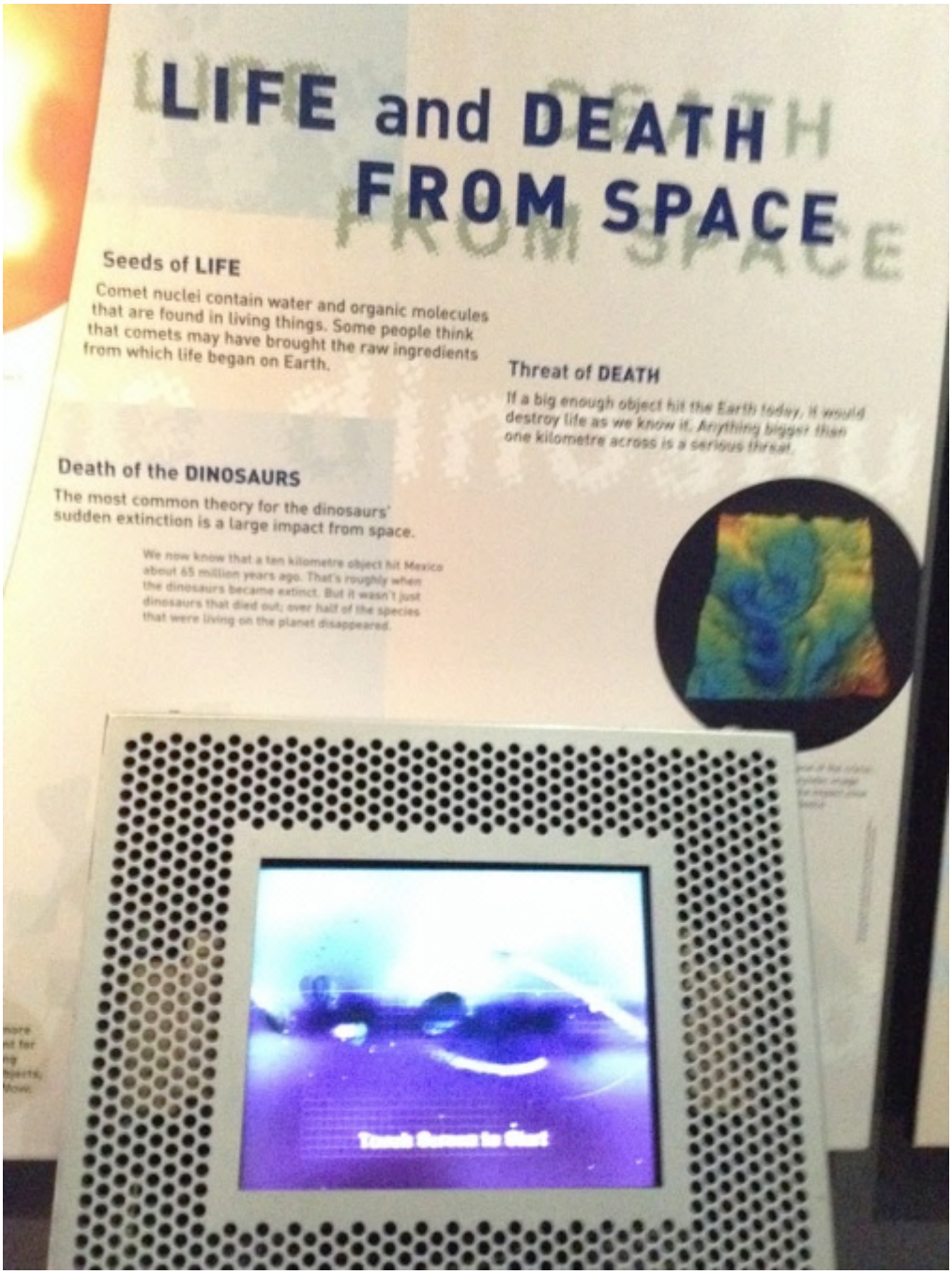

Figure 7.11: 'Destruction of the Dinosaurs/ Destroy the Planet' interactive in *Looking Up*. Image by author, used with permission of NSC.

There are no discernible differences in the type of interactive format and the interface of the station that are aimed at older children versus those who it was assumed younger children would also use. This demonstrates an overarching opinion of digital literacy skills across all ages of child visitors, but also including a similar view of adult digital literacy skills. With a singular view of digital literacy for such a wide range of ages, assumptions about children's levels of digital literacy would have been high, as each of

the interactives suggests that children would need to know how to operate the device (a range of touchscreen and computer-based options) as well as understand the message presented for educational purposes (not just enjoyment).

A good example of how interactivity in the Centre lasted long-term is *Planet Earth* gallery, which sits in the Centre between *Space Now* and *Looking Up*. The gallery contained both physical and digital interactives when it opened in 2001, however, it became apparent afterwards that it was not as popular a space as the other galleries and at the end of the first decade of opening it was decided to redevelop part of the space into a more useful area, something that would be interesting for visitors as well as useful for business ventures (Yates, pers. comm. 31 January 2013). On the reason to redevelop the gallery, there were 'graphic panels that no one is looking at. We've got interactives that no one is interested in' (*ibid*). The content 'was out of date and not very interesting', showing the static nature of the gallery, even with the digital interactives (*ibid*). It was an opportunity to design a new gallery that worked both as a place for visitors that linked the other galleries, but also as a space that could be used (and has come to be used) for activity days and family projects during school holidays. It was also an opportunity, even more so, to redevelop what had obviously been a design with too many incorrect assumptions about how visitors would use the space and the type of interactivity they would want. This gallery is therefore similar to *Space Now*, which was also heavily interactive, but found after opening to not work as well with visitors as hoped. Assumptions about visitors' digital literacy and engagement had clearly been made in the first design of the Centre, and only after observation and evaluation of visitors were those assumptions understood and corrected. During observation for this research project, the *Planet Earth* gallery seemed very popular with visiting families, particularly the more physical interactives, as most of the digital ones had been removed. Only the digital 'WeatherPod' (discussed in 7.3.3) dominates the space and always has a line of waiting children to use it.

One interactive in the *Into Space* gallery has recently been reworked (in 2013), to adopt a more workable approach for children, as it was found the original interactive was not used by visitors (Law, pers. comm. 13 February 2013). The interactive was of the International Space Station (ISS), which had originally been static, but Law used the idea of lighting the various areas of the model using spinning lights (quite obvious) that

visitors operate themselves. This replaced the old interactive, which had simply shown a fly-through of various areas of the station when buttons were pressed. The new interactive allows visitors to engage with the actual model of the ISS which is in the gallery. A new onscreen model provides visitors with an opportunity to 'fly', giving a tactile experience to a digital interactive (*ibid*). However, Law also stated that since the interactive had been redone 'kids like bashing it', showing that although the redevelopment of the exhibit was designed to increase children's interest and engagement, the reality of the assumptions made suggests that there are still issues to be uncovered (*ibid*). As previously suggested, the lack of engagement with the redeveloped interactive could stem from several reasons. However, the fact that it was redeveloped to be visually more appealing (with lighting), but children are still unable to engage with it in the way Law intended, suggests a deeper reason than simply a lack of interest in the subject. Keeping this in mind, however, the opinion that enjoyment of exhibits is as important, if not more so, than education and learning, particularly for young children is backed up by Law (pers. comm. 13 February 2013): 'entertainment is the most important'. If bashing the controls is entertaining, then children have received a measure of enjoyment from it, which was Law's original intent.

7.2.3 Assumptions at the Herbert

As at WPM, the Herbert also chose to include several interactives in each of its galleries (excepting the art gallery) during redevelopment. This was in contrast to the old centre in the early 2000s, where there were few interactives due to limited resources (Roberts, pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013). The place of digital in the galleries came, almost entirely, from a desire to create exhibits that could get across levels of information.[69] In certain cases, these levels of information were to appeal to both children and adults (families) who would therefore be able to use the interactives together (*ibid*). This is especially apparent in the 'Build a Watch' interactive in the history gallery, which was designed as a digital system because staff could not get across the desired information through a manual idea (*ibid*). Partly, the *History Gallery* needed to be curriculum led to service visiting school groups (as such, the gallery is divided into medieval, Victorian and 20th century), but to appeal

[69] The *Discover Godiva* gallery has already been discussed as the sole gallery that was heavily interactive for reasons of its audience.

to families as well the interactivity served a role (Taylor, pers. comm. 15 April 2013). The interactive to build a watch is a simple touchscreen with various choices of what watch parts to use to construct a timepiece, with various accompanying text explaining the pieces of the watch. It is a relatively simple system to operate, however it does require visitors to engage with the information presented in order to understand its purpose and to relate the interactive to the rest of the exhibit in which it sits (nearby display box of watches). A reasonable level of digital competence and literacy would be needed to use the system in the way staff intended, making it a requirement for adults to use the interactive with children, rather than children on their own, though Roberts suggests it was meant to be a fun interactive to appeal to children (Roberts, pers. comm. 27 March 2013). Figure 7.12 shows an example of the wording on the interactive screen that explains to the visitor what each part of the watch does.

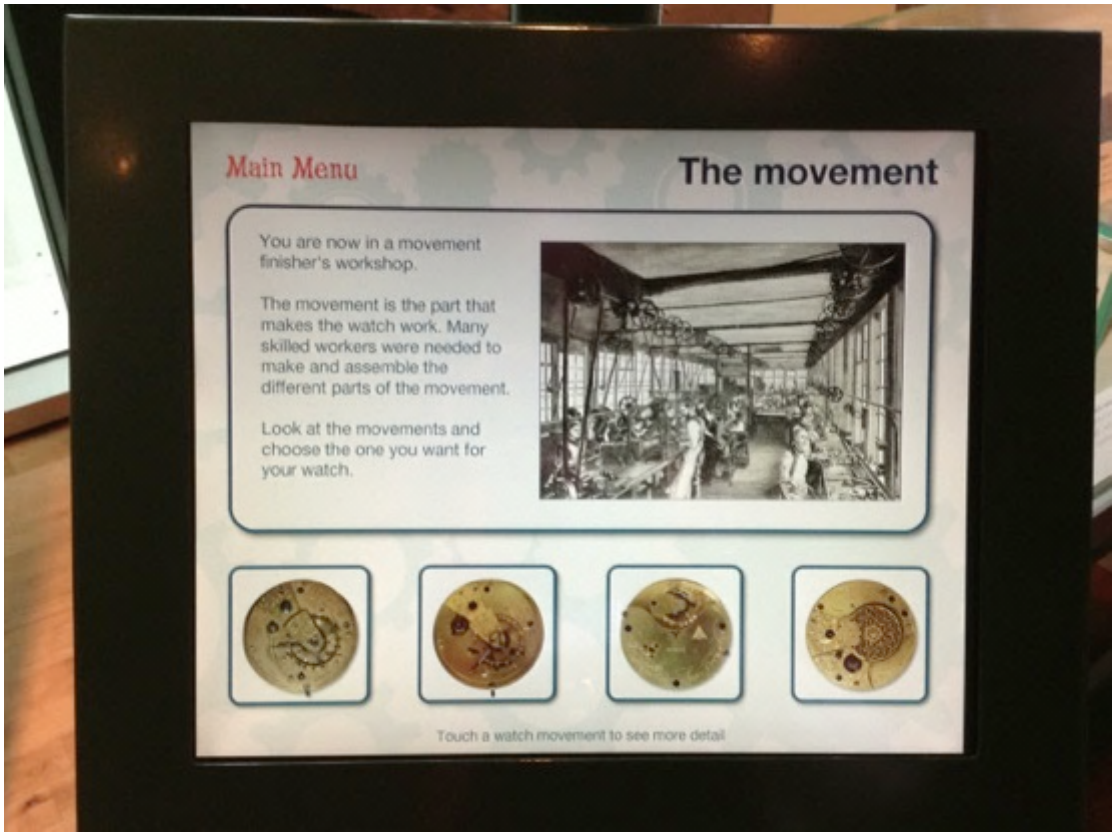

Figure 7.12: 'Build a Watch' interactive in the Herbert's *History Gallery*, showing one of the steps. Image by author, used with permission of the Herbert Art Gallery and Museum.

This is similar with the 'Digging for Victory' rationing game in the same gallery, which was aimed at families, but does seem to require high digital literacy to fully operate, again with the expectation that adults would always be in place to assist children in

using the system (Herbert, 2007b). Both interactives use very simple text and mostly images to convey their messages, suggesting that they are aimed directly at children who are less likely to read text, but will gravitate towards interactives that contain pictures. Though the optimistic digital literacy discourse may not be obvious here, there are subtle assumptions made by staff in who would make use of the interactives and how they would do so, and that children would have a level of digital literacy high enough to participate (perhaps with parental help) in using both interactive systems, and asking questions relating to the exhibits around the digital interactives.

The Herbert created a watercolour exhibition (temporary) in 2012 that contained a computer interactive. The intention was for visitors to use the computer to place where the watercolours of local artists had been painted in the area surrounding Coventry, 'You touched a hot spot and an image popped up of the painting and information about that location' (Roberts, pers. comm. 27 March 2013). However, though this was the assumption behind it, staff soon discovered after opening that visitors were actually using the computer to surf the Internet, running down the Internet credit that the Herbert had purchased for the device (*ibid*). Clearly there is an issue here with how staff assume visitors will use interactives (i.e. they assume the visitor will use it as intended). But there is also an issue here with digital literacy. Staff also assumed that visitors' digital ability would allow them to engage with the interactive in the way intended, understanding the purpose of it and its association with the paintings on display; instead, however, visitors displayed only basic levels of literacy by checking the Internet and 'we discovered people were getting football results on Saturday' (Jones, pers. comm. 27 March 2013). This harkens back to Buckingham's view of children's digital usages as often 'banal' forms, because they do not actually have the ability to engage at a higher level with the information (2015: 14).[70] The ability to engage with systems in the way they are designed and to explore the learning potential in this particular painting interactive were ignored by visitors whose interest was more focused on how they used digital at home. Though some of this lack of engagement is likely a lack of interest on the part of the visitor, the fact that the interactive was not designed in a way to ensure visitors could not abuse it and could only use it as intentioned by staff, suggests that staff incorrectly estimated their visitors and their digital usage. This

[70] Buckingham has used the term banal in previous articles, but his most recent publication that examines the use of this word is from 2015.

example raises the issue of overestimating visitors' use of technology and also the ways in which they will engage with it.

Richard Elms in his work with young people in planned out of school workshops has found that children seem to naturally take to digital projects. 'We find that kids are…it's just more natural to do things' and because of this, the continuing digital projects, like photography and sound recording, are the basis of the young people workshops (Elms, pers. comm. 15 April 2013). Elms has found his students to be 'a lot more digital natives than if we were, say, working with a group from a museum', they come with their own camera phones that they already know how to use (*ibid*). The use of technology by these adolescents is 'second nature' (*ibid*). This does not demonstrate optimistic discourse assumptions about interactives, but it does demonstrate optimistic discourse of child digital literacy in a Herbert staff member, which perpetuates assumptions made by the staff in exhibitions and digital designs (such as the Herbert's new iPad trail).

7.3 Optimistic Discourse at the Prototype Stage

We have now reviewed the requirements and design phases of three museums, evidencing the assumptions about child digital literacy that aligns with optimistic discourses. So far in this analysis of design assumptions in the in-gallery digital projects of these museums, we have seen that there is a large body of evidence that is more popular and optimistic in its assessment of digital literacy than realistic. Regarding the first of our research questions on understanding what assumptions have been made, there is already a clear suggestion that assumptions about child digital literacy are more likely to be popular and optimistic, rather than academic and realistic in these institutions. Already we have found substantial implications towards the second half of our research question, of whether there has been change in these assumptions from the early designs of the 2000s to recent 2013 projects. Continuing with this discussion, we will see that this continuous timeline of optimistic digital literacy assumptions, which we defined in Chapter 3, are evident in the last two phases of the design process as well.

As with Chapter 6, there are more obvious gaps in projects within the following sections, as has already been explained. Where assumptions exist in the data, in the

appropriate stages, they have been included in this chapter under prototyping and evaluation. To review, prototyping is the step following design (which is typically written documentation) that is characterised by either sketches or drawings of the prototype up to and including a full working prototype of an interactive.

7.3.1 Assumptions at the Herbert

At the Herbert, the only prototyping documentation that was available from the original redeveloped was the 'Coventry Time' interactive (Appendix D), which has already been referred to. The prototyping phase took place over the beginning of 2008, and was complete just in time for the final design prior to opening (Herbert, 2008b). However, the prototype itself went through various iterations from the beginning of that year through May and included a review of the interactive with suggestions for corrections before the finale design, showcasing a very good example of the design process in action at the Herbert. The interactive was partly a database of the collections pocket watches and partly a game to assemble a watch based on those in the collection. It is this second part of the interactive that was to appeal most to children through the idea of 'play'. However, the interactive still contained a good deal of text in its early iterations (Herbert, 2008c). Later comments pointed towards a desire to make the game more 'jazzier and brighter' in order to interest children rather than adults (Herbert, 2008d). However, the game still required visitors to read instructions and to understand the steps of the watch building in order to engage with the collection in the exhibit around it and the game could not be solely operated via images or symbols, demonstrating that a level of digital literacy was required in order to operate the interactive the way staff intended. Specifically through following each step in the nine sections in order to construct the watch piece by piece and to understand how each part of the watch could form a fully working timepiece comparable to the ones in the nearby display case.

The most recent project at the Herbert has been an iPad application for school group visits, (referenced to above in 'Requirements' section of Chapter 6). An outside company created the prototype for the interactive in August 2013. The prototype shows a colourful screen selection that heavily relies on images rather than text. However, there are obvious assumptions made in the digital literacy of its potential users. For one,

the subject matter of the interactive is historical, meaning that users would need a level of literacy in order to engage with historical facts and events relating to Coventry and the Herbert's collection. For another, part of the interactive aimed at school children include a comment page relying on students to read and respond to a question and use an iPad keyboard. The quiz that forms one aspects of the iPad application is a simple multiple choice format, but questions need to be understood and correctly answered in order for students to score points and based on user ability to find the required information (Hartwell and Dean-Corke, 2013). This is a high expectation for Key Stage 2 and assumes a mastery of iPad technology by students as well as the ability to access information presented through a digital programme, particularly when the assumptions detailed in the requirements section for this project are recalled.

7.3.2 Assumptions at WPM

At Weston Park Museum, finding prototyping documentation proved difficult during the research phase for this project. It could be suggested that one reason for this lack of documentation is that WPM typically outsources their digital designs, and therefore prototyping documentation would be more likely to be kept by the design company. However, as the lack of prototyping documentation from Haley Sharpe Design for the NSC has shown, this might not, in fact, be the case.

Equally, however, there may simply be little prototyping documentation from previous digital interactive designs. One reason for this is, perhaps, the iterative design that WPM has employed since the centre was redeveloped. The first design was the 'Designed for Life' interactive, previously discussed. From here, WPM chose to reuse the same type of interactive with a similar purpose and format for later exhibitions, adapting the subject matter to suit a new theme. Rowena Hamilton (pers. comm. 11 March 2013) claims that the later 'Design an Athlete' interactive in the *Sports Lab* exhibition (previously discussed) 'we got the original idea from a superbug interactive that is on the My Learning Website'. However, the 'Design an Athlete' was remarkably similar to 'Designed for Life', about creating a figure for a specific purpose (an athlete for a specific game or a creature to survive in a specific habitat). Wherever the original idea for 'Design an Athlete' came from, Hamilton reasons that 'we're thinking that that same idea in part of our gallery redisplays, we're thinking that we could redesign that

interactive again, or reuse that idea again to create quite an interesting interactive about designing an animal to compete in a particular area' (*ibid*). Despite outsourcing much of their designs, WPM showed that they can take an interactive that they knew was popular with visitors, particularly children in 'Designed for Life' and adapted it towards a new exhibition. However, by doing this, similar assumptions from the original interactive would necessarily be remade; the 'Design an Athlete' interactive makes the same design assumptions about its child users and their digital literacy as 'Designed for Life' made half a decade earlier.

7.3.3 Assumptions at the NSC

The original 'TV Weather Studio' (now 'WeatherPod') at the NSC was developed for the *Planet Earth* gallery to demonstrate to visitors how weather studios work and how difficult it can be to deliver the weather using a blue-screen (Haley Sharpe Design, 1999-2000). The interactive was designed for five years and older, but specifically targeted at families rather than a range of ages from children to adults (Haley Sharpe Design, 2000a). Unlike most of the design briefs archived by HSD, this particularly interactive has a paper prototype (Haley Sharpe Design, 1999; Haley Sharpe Design, 2000b– see Appendix D). The visitor selects their chosen forecast from a screen outside the weather studio, and is given a number. When that number is displayed, they enter the studio to perform their chosen forecast. The interactive requires a good level of information literacy through digital in order to understand what is required and to read out the forecast. There is a series of steps the visitor needed to engage in in order for the interactive to work correctly, starting with selecting their chosen forecast outside the studio and then following instructions on screen inside (*ibid*). Though the text for the interactive was kept simple (using symbols where possible for choosing the weather forecast) and simple wording inside the studio, a significant level of digital literacy was required to fully participate in the interactive, particularly for younger children who might also have a reading literacy barrier. Though aimed at families, the age for the interactive was specifically five to fourteen years, suggesting that the intention was for younger children to make use of it (rather than adolescents) (Haley Sharpe Design, 2000a – see Appendix D). This would have been technology unfamiliar to visitors as it would not have been available at home (touchscreens, blue screen, teleprompter) and therefore assuming that young children would easily understand and be able to

following the steps in order to make full use of the interactive in performing a weather forecast (rather than using it for play) seems questionable.

Graham Law prototyped the 'ISS' interactive in 2013, trying several versions of projected lighting onto the ISS model to make it part of the original gallery interactive. He tested the lighting effect with the digital interactive fly-through over a period of several weeks, compiling a working prototype that could then be finalised into the gallery exhibit (Law, pers. comm. 13 February 2013). 'So the whole thing is quite a joined-up 3D interactive. And I like that. That's good. Unfortunately it's not finished yet, but you can see the way we're going with it. But there's always going to be technical challenges' (*ibid*). Though Law assumed that children would find enjoyment out of using it, 'kids like bashing it', supporting Yates 'hit all the buttons' observation (pers. comm. 31 January 2013), but he also hoped that the new interactive would educate visitors about the ISS. However, to do so, children would need a level of digital literacy that allowed them to read the accompanying information and to understand the correlation between the information on screen and the model above their heads.

7.4 Optimistic Discourse at the Evaluate Stage

This last stage of the design process is, as we have seen in Chapter 4, the key way for designers to develop their understanding of their user through a review of how the digital interactive worked with the user. In the case of museums, this allows staff to observe and record the positives and negatives of a certain design and to learn from the experience going towards further projects. As we have seen in Chapter 6, evaluation is a step that is often left out of design projects in museums and as such, few assumptions have been made which can be discussed here in light of optimistic discourses. Many of the projects that have been used as examples in this chapter (and the last) have shown their assumptions within the design process, rather than after completion (when evaluation takes place). In this sense, evaluation serves as an opportunity to learn how a design could be improved and what lessons can be learned for the future.

7.4.1 Assumptions at the NSC

As with Chapter 6, we will start evaluation by reflecting on the NSC's practices, both with the *Space Now* exhibition redevelopment that we are familiar with and with the 'Sun, Earth and Moon' exhibit, which was previously used to showcase realistic discourse assumptions during evaluation.

For the *Space Now* evaluation, it should be pointed out that this was carried out by outside evaluators, not the NSC staff, and as such the assumptions made were by Parry and Crusciel. However, keeping this in mind, it was the 2006 evaluation of *Space Now* that lead to the redevelopments undertaken by the NSC. It is the 2008 evaluation that was conducted after the changes in the gallery had been put into place that is the focus of this section, and this summative evaluation study therefore reflects on optimist discourse assumptions that went into the redevelopment. In the 2008 report, the evaluators detail that the central touchtable, previously discussed, was the most popular element in the new gallery, while the redeveloped web terminals were used by less than 50% of visitors (Parry and Crusciel, 2008: 13). This suggests that during the redevelopment assumptions about visitors' web usage and interest in web technology was over emphasised, and indeed the report mentions that the web terminals 'appear to stimulate much less interaction within family groups' than hoped for (*ibid*: 14). This suggests that during the redevelopment, optimistic discourse assumptions of users' digital literacy ability and their need for technology outweighed those of realistic discourses. This is backed up by the visitor comments within the report that say that there were issues with the amount of text presented, in that it was too much information or difficult to understand. Even more, the interactive quiz terminal added to the gallery had the largest issue with showing optimistic assumptions in digital literacy as the report discovered that this interactive was underused after redevelopment, but more importantly that 'some visitors experience [difficulties] in orienting themselves with this novel piece of technology' (*ibid*). This new form of interactive unfamiliar to visitors caused the most issues amongst visiting family groups, whereas the new touchtable appeared to have fewer usability issues.

A similar example of popular and optimistic discourse assumptions of visitors' digital literacy appeared in the 2013 development of the interactives added to the *Looking Up*

gallery. Staff created three interactives for visitors to accompany information about the Earth, the sun and the SOHO satellite that hands from the ceiling of the gallery. During a short evaluation period at the end of prototyping, as interactives were fit into the gallery, the designers discovered that for the 'SOHO' interactive, the fact that visitors needed to press a button to operate the game was not obvious, and a flashing green light had to be added to make it clearer (Yates, pers. comm. 19 June 2013; Howell, pers. comm. 12 August 2013). For 'Today's Sun' interactive, an arrow had to be added to the wheel on the touchscreen to make it obvious it needed to be 'turned' in order to advance the images on screen (*ibid*). And lastly, the 'Google Earth' table, though common technology, did not operate in the same way visitors seemed to expect, and a key had to be added to the corner of the touchscreen to show visitors which finger motions would control the table (*ibid*; Howell, pers. comm. 12 August 2013). Though Yates or Howell did not specifically mention that visitors they observed were children, there was an overestimation of visitors' (in general) digital literacy and ability to operate new types of touchscreen technology in the exhibition.

7.4.2 Assumptions at the Herbert

As we have previously discussed, the Herbert undertook little formative evaluation during its redevelopment phase in the early 2000s. Rather, staff at the museum designed most of the content themselves, not the external design company, and did so based on 'a wealth of knowledge that had been gained through previous activity around those [the gallery] topics' (Taylor, pers. comm. 15 April 2013). The staff were able to draw on ideas they had seen at other museums and use that to develop ideas for the Herbert's content (Roberts, pers. comm. 27 March 2013 and Jones, pers. comm. 27 March 2013). It is because of this lack of evaluation prior to and during the redevelopment that staff therefore had to make assumptions about their visitors based on their knowledge of previous designs and projects in the 1990s. However, a lack of resources for formal evaluation continued after the centre re-opened in 2008 and it has been an issue with more recent projects as well, as Richard Elms (see Chapter 5) stated. This became apparent with the Herbert App, which went public in 2011, but was pulled eighteen months later because of several issues with its usability, due in large part to a lack of understanding of the end user it was designed for (Elms, pers. comm. 15 April 2013).

Mel Corner's realistic discourse on digital literacy was reviewed in Chapter 6, however she had also made an interesting optimistic assumption that was not found in how she designs her programmes and exhibits. Corner discussed having completed observation in an early years school as part of her work and had watched a young child of roughly four use a computer game 'better than I could' (Corner, pers. comm. 11 July 2013). Corner (*ibid*) went on to state that 'children are changing, are certainly changing in the way they are able to interact with things', however she cautioned that this did not necessarily mean understanding. Her comments, unique amongst the Herbert's staff both in academic and popular discourses, show a more measured approach between the two opposing views, however as the comment about the four-year-old child shows, even public opinions of digital literacy have made it into Corner's own discourse.

7.4.3 Assumptions at WPM

In the requirements section of this chapter, one of the examples given at WPM was that staff had made an assumption about visitor conversations amongst inter-generational groups. A reference was made to the fact that staff assumptions had not been found true in evaluation undertaken after the centre re-opened. This evaluation was part of a PhD student's project that looked at young children in the gallery and how they engaged with the space (Travis, pers. comm. 8 April 2013). The research, by the PhD student, found that children under five are 'not bothered what the objects are, they interact with the grates on the floor to make the noise, the lights, they like to jump on and off them, they have the music and they like to dance to the music and art' (*ibid*). The PhD research project concluded that under-fives did not come to the museum to use digital interactives or to learn educational information about the museum's collection; instead they came to explore and develop awareness and social skills in a public place (*ibid*). Though none of the digital interactives in WPM are specifically aimed at such young children, staff knew that under-fives formed a part of their audience, and yet they assumed that the highly digital interactive galleries would suit such a young demographic.[71]

[71] Observation in WPM over the course of several months during 2013 suggested that under fives in fact form a large part of the museum's visiting child audience.

The new WPM iPad treasure hunt has been discussed already in some depth. However, with the realistic assumptions that went into the requirements phase of the project, there was also an obvious optimistic assumption. That is that it would be used by a younger generation that 'allows them to interact with the collection in a way that makes it, maybe, a bit more exciting for the younger audience, a challenge to find certain pieces' (Silvester, pers. comm. 11 March 2013). The iPad trail would also give children the opportunity to create content through production (*ibid*). These lofty goals of the new trail show that users would need high levels of digital literacy to make use of the trail as Silvester intends, leaning towards the very optimistic ends of popular discourse, particularly where the ability to produce and create is concerned.

7.5 A Continuity of Widespread Optimistic Discourse

As with Chapter 6, there are several key findings from this systematic investigation into assumption in digital literacy within the design process. This section will link with section 6.5 and begin to suggest (and as Chapter 8 will conclude) an outlook on optimistic and realistic digital literacy assumptions where, in the case study museums, there has been very little change.

The National Space Centre, of all three case studies, provides the best outlook on fifteen years of practice, owing to its development as a new Centre in 2001. It also provides a wealth of data in which to analyse staff assumptions about visitors over that time period, both before the Centre opened and in the years since design has been undertaken for a more nuanced audience. Within this, the evidence shows that there is a decided focus on optimistic discourse assumptions about child digital literacy apparent at the NSC, both in its current staff as well as in its original design teams. Interactives designed for the original opening in 2001 have been popular with visitors just as newer technologies in the NSC galleries are more recently, particularly what is perceived to be new and different technologies. However, the data gathered on the interactive designs demonstrates that the NSC does not appear to have taken into account that visitors would have problems with using the technology in the way it was designed to be used (see new 'Sun, Earth, and Moon' exhibit), and that certain interactives might be less popular than others (see 'ISS' interactive). More recently, projects at the NSC have

failed to account for child digital literacy in its realistic sense, leaning heavily towards optimistic discourses in how children gravitate towards and use technology for entertainment purposes. The caution amongst staff designing interactives has been only that, if there is an issue with the interactives, at least children will still find enjoyment from using them, even if the message or lesson of the digital system is lost to them.

In more specific examples of project from this research, the original 'TV Weather Studio' (now 'WeatherPod') and the more recently redeveloped ISS interactive require high levels of digital understanding in order to fully explore the outcomes of the interactive and relate those outcomes to the larger issues explored with the surrounding exhibition, though levels of digital literacy needed to operate the actual systems are reasonably low. Despite this, unfamiliar technology in the original 'TV Weather Studio' design was obvious in order to appeal to visitors' sense of it being something new and different, but therefore more complex, despite the young audience the interactive was aimed at.

In *Space Now*, the data demonstrates that, during the redevelopment, several key assumptions about digital literacy played out after the exhibit opened and showed that web terminal technology could be especially difficult for children to operate as it needed a level of information literacy as well as digital literacy. The newer 'Sun, Earth and Moon' redeveloped exhibit in *Looking Up* also required information literacy to understand the importance of the digital interactive themes presented, while requiring digital literacy to operate the interactives. Several problems were encountered in the designs prior to opening the exhibition in 2013 that required fixes to simplify, or at least make the instructions more obvious.

To look back on the evidence gathered for this study at the NSC, over fourteen years of design, is to understand that there have been both realistic and optimistic digital literacy discourse assumptions made. However, the optimistic assumptions outweigh those of the realistic ones, perhaps owing to the main fact that the Centre is geared towards enjoyable experiences and 'edutainment'[72], rather than the focus on educating the visitor with facts or themes as museums have typically done in the past (if not in the

[72] Discussed in section 1.4.1.

present in many cases). The desire to be more entertainment focused has led to a prevalence of technology use in the Centre, and often in a way that is intended for play over (though not entirely in spite of) learning. This may explain the prevalence of such optimistic assumptions about children and their digital abilities when visiting the digitally rich NSC. The science and space themes of the Centre have also lent themselves to a wealth of technological exhibits, and the focus on the technology has, at times, seemed to outweigh that of the content. Despite these perceived issues identified in the thesis, that have shown themselves amongst visitor engagement with the technology and evaluation studies such as Space Now, the popularity of the NSC continues to drive forth its development. Staff at the NSC that have been involved in the more recent design projects have been slowly learning from their past expectations of visitors and adapting to suit their child visitor needs, in the end understanding that an enjoyable visit can often be more important than fully grasping the finer nuances of all the interactive technologies.

As we have seen in Chapters 5 and 6, Weston Park Museum and the Herbert share several similarities. When WPM was redeveloped in the early 2000s, the new museum became heavily interactive on a physical level, but there are many examples of digital interactives as well. In the original designs for the galleries, interactives were seen, at the time, as required in a family-centred museum. The evidence in this study has shown that the intention behind the digital interactives was to create a way for children and adults in groups to make use of the exhibits together, with children operating the interactives and adults serving in the capacity to answer questions. However, research since the redevelopment of WPM has shown that this was not typically what happened with inter-generational groups, but rather that children did not ask questions of adults during the visit, and that conversation was only sparked after the group had left the museum. There, children typically make use of the interactives on their own, without engagement to the wider exhibit. This was especially true of very young children, who in fact were more likely to make use of the gallery space than any objects or interactives in the galleries.

It is because of these underlying design assumptions in the redevelopment that staff and designers underestimated how children would use the interactives. Evidently, this has continued into more recent designs, such as *Sports Lab* and the most recent iPad trail

development. High levels of digital literacy are required, not to operate the systems, but to understand the themes and information presented through the digital games within the galleries and to engage with these in conjunction with the wider exhibits in order to be educational.

The research shows that digital at WPM has become so mainstream and expected that the most recent 'adult' oriented gallery of Japanese enamels on tour from the V&A had interactivity added to it in order to bring in a family audience. Along with this is a sense from the visitors to the museum that it is a family-centred institution and too interactive for an adult population to fully enjoy.

Over ten years, this research has shown that WPM has made many digital literacy assumptions, both academic and popular, realistic and optimistic. Their popular discourse based assumptions stem from the expectation that their visiting family audience expects interactives during the visit and that children need interactivity in order to be engaged in the galleries. Popular interactive ideas, such as 'Designed for Life', have been reused in later galleries and exhibitions, despite little evaluation to suggest how successful the interactive is on a level above simple enjoyment. This has manifested in the most recent project, the iPad app, which requires children to not only make use of iPad technology, but to do so in a way that engages with and seeks to understand the museum's collections and go further into content creation. As we have seen in Chapter 3, content creation is one of the highest forms of digital literacy, as it requires several steps of understanding in order to reach. This shows high expectations of visiting children to WPM even in 2014, with the scarce academic evidence to suggest that children innately have such high levels of digital literacy ability.

As with the NSC, however, there is a cautionary note to such expectations of child digital literacy, in that the popularity of interactivity may be just as important as the educational value of using an interactive in a museum. If this is so, the interactives at Weston Park Museum are, for the most part, very popular with child visitors, as perpetuation of similar designs have shown. Children who use digital interactives are therefore being given the opportunity to increase their levels of digital literacy, though without adult instruction or assistance to ensure that they are actually learning and not just playing. Providing a family friendly space for children and adults to enjoy a visit to

a museum has always been a central intention of Sheffield's WPM, and in this way they are succeeding.

Weston Park Museum and the Herbert in Coventry also share a similar outlook on the necessity of interactivity for visiting children. This was apparent in their redeveloped galleries, but also in more recent temporary exhibits for children that use high levels of engagement and physical interactivity (less so digital). In the original redevelopment, nearly all the galleries contain several examples of digital interactives, as well as physical ones. The digital interactives are linked with the surrounding exhibits (specifically the collections) and therefore serve as a way to engage with the displays, thus requiring digital literacy to grasp the information and themes presented through the computer systems. As the galleries are aimed at Key Stage 2 children and families, the evidence points towards a noticeable assumption from the early 2000s that children would be able to grasp the concepts apparent in the digital technologies and use them as their way into understanding the collections. 'Coventry Time' in the *History Gallery* is the prime example of this assumption, as it required visitors to read instructions, but also information as they build a watch to serve as a more nuanced layer of information in conjunction with the surrounding display about watch making in Victorian Coventry.

What is more, amongst the Herbert's staff, evidence would suggest that there is a sense that technology is a normal and accepted part of children's lives in more recent years. One staff member, Taylor, went as far as to comment that she feels that children are naturals with technology, even 'digital natives'. She feels that adults see technological use by children as an issue or a problem, but that it is not so amongst children themselves (pers. comm. 15 April 2013). However, this feeling is somewhat in contrast to what staff discovered in the years since the centre reopened in 2008. They found that visitors did not make use of educational interactives in the way designers had hoped, but sometimes found ways to appropriate the educational aspects for more banal uses, such as checking personal emails on touchscreen interactives. This suggests very low displays of engagement in visitors of all ages, rather than higher levels that should come with media literacy abilities in realistic discourses with the use of educational and information technologies in the galleries (as they were designed to be).

Most recently at the museum, a new iPad trail for visiting school groups has high levels of interactive technology and requires complex digital literacy abilities to make use of in the way designers hope. The trail relies on the use of camera technology, information searching and testing and the wider systems available on an iPad, but is designed for use by Key Stage 2 children on their own. It is an interesting comment that the Herbert has decided on a new application of this type, as the original museum app for the public which launched in 2011 suffered from multiple design and end-user issues and was pulled in 2012 (re-launched in 2014). Evidently, there is an expectation from staff that this failed app was a learning experience, and those lessons can be applied to the new iPad trail. However, conversations with staff presented in this chapter show they there are still high expectations of digital literacy from young children amongst most staff. It is only Mel Corner, who has designed a number of the more recent temporary exhibitions for children, who shows a decided understanding of realistic discourse. As Chapter 6 demonstrated, Corner is concerned about children's technology use and its place in museum galleries and prefers physical interactivity. She also commented that she had observed a very young child make use of a digital game with more skill than she felt she would be able to display (Corner, pers. comm. 11 July 2013). This conjunction of realistic and optimistic discourses within a single staff member is unique at the Herbert amongst the case study museums. It perhaps suggests that Corner's work in schools and with learning (the main focus of her role) has given her a wider understanding of the debates surrounding digital literacy, though such understandings are not apparent amongst her colleagues at the Herbert.

According to the data gathered for this study, the Herbert shows a decided optimistic assumption in regards to child digital literacy and technology use in its galleries, from the redevelopment through more recent projects. What is more, there is no obvious change in the assumptions that are made, particularly amongst the popular discourse opinions. However, several staff do show some grasp of the academic debates and cautions surrounding expectations of how digitally literate children are (Corner and Elms) and this has had an impact on practice in gallery design and programming.

7.6 Conclusion

This chapter has demonstrated the assumptions of child digital literacy in museums by staff involved in the design of digital interactives. Unlike the previous chapter, this particular view has shown the popular discourse in digital literacy, demonstrating views that reflect an optimistic opinion of children's ability to use digital and their desire or need for digital. Similar projects have been showcased in both chapters, which indicate that both popular and realistic assumptions can be made in conjunction with each other, and even be made regarding the same step in design.

Chapter 7 has concluded that, as with Chapter 6, evidence would suggest that there has been little noticeable change in popular discourse opinions, by staff, of child visitors' digital literacy over the course of the last ten to fifteen years at these three museums. There have been small changes that can be attributed to specific staff members (such as Mel Corner at the Herbert), but overall the main optimistic opinions of how children engage with digital interactives in museum exhibits and their need for digital interactivity in their visit have been clear throughout. This lack of apparent change (evident in the data and material gathered in this research) provides an interesting answer to the second research question that postulated if there had been change and what that change had been. The similarities across the three museums, as well as across various developments and redevelopments in the galleries demonstrate a stable view of children in museums, at least regarding digital literacy enabled assumptions. These three institutions are, we have seen, very different in their structure and design processes. The continuity in assumptions about children and the design of digital systems for them, despite these differences, presents us with an interesting idea. The fact that such a stability evidently exists within realistic discourse (Chapter 6) and optimistic discourse (this chapter), suggests that the issue with a lack of change in assumptions and staff understanding is one that occurs within the museum as an institution itself, and is not dependent on museum type, subject or (as Chapter 5 showed) production method.

This chapter concludes the main analysis area of the study. The discussion now moves, finally, into the thesis' conclusion. This will review, in brief, the findings of these last chapters (linking chapters 5 through 7) and discuss the limitations of this study, as well

as reflect on other interesting aspects of the research that have emerged and where this study might lead to next.

Chapter 8: Conclusions

8.0 Summary

This research project set out, using an innovative combination of theories, to uncover what assumptions were made by staff in museums about children's digital literacy when designing digital interactives. The analysis has been centred upon three case study museums within England, each of which typifies both common production models of design as well as subject matter. In each of the three museums, the research surveyed digital projects over fifteen years (since the millennium) undertaking detailed data collection of design documentation and project archives as well as carrying out in-depth semi-structured interviews with a range of curatorial, technical and design staff.

Chapters 2, 3 and 4 laid out the theory and literature behind the key topics raised in this thesis. Chapter 2 considered the ways museums have used digital technology for exhibition as well as the previous research that had linked and reflected upon technology, children and museums. Informed by media studies and communication studies, Chapter 3 attempted to introduce a more nuanced view of children and technology by delving into the field of media and digital literacies in children over the course of the last twenty years. Here, significantly, the varying discourses in the field of digital literacy (specifically) and the current dichotomy between optimistic understandings of child digital literacy and realistic research into the field were identified. In doing so Chapter 3 set out to build the intellectual framework for the discussion to follow, specifically in terms of debates around (and differentiations between) the discourses of child digital literacy. Chapter 4 then introduced the theory of user-centred design and its associated fields to rationalise and direct the data collection and analysis. As well as introducing UCD and presenting its main theories, principles and components, the chapter also, importantly, considered the 'Four-Step' design of digital interactives. It was this design process (its terminology and its components) that was then used to direct the focus of the fieldwork as well as to structure and keep focus within the analysis.

Chapters 5, 6 and 7 presented the data collected for this research project. Chapter 5 presented the three case study institutions and their histories and explained how each

case study museum (the NSC, the Herbert and WPM) showcased different types of digital design over the years. This allowed for the differences and similarities in the institutions to be understood before reviewing specific design projects and assumptions. Chapter 6 then presented, through design projects at each museum over fifteen years, the assumptions that staff members have made about what they see as children's digital literacy that might fall within a realistic or measured discourse. It was suggested that some assumptions, though not all, do come from an understanding of children's digital literacy that is predominantly realistic in its orientation. Then, changing focus, and switching to the other main discourse identified in Chapter 3, the thesis, in Chapter 7, investigated the optimistic discourse detectable within these projects in these three different production environments. The Chapter attempted to show that not all assumptions in the institutions have come from a fully developed view of digital literacy, but rather that many assumptions had been made during the design of projects that were instead from what media studies would consider a more optimistic (even popular) perception of children's levels of ability with technology.

The aim of this study was to present the assumptions made by museum staff of digital interactives in museum galleries and what impact these assumptions can have on how technology is designed for child visitors. The intention has been to make a case that when designing in-gallery digital interactives for children, museums tend to adhere more to an optimistic discourse of digital literacy than one that might be seen as realist, and that – furthermore - this is a tendency that has persisted over the course of many years of design.[73]

8.1 Outcomes from the Research

Drawing upon the work of authors such as Eschet-Alkalai, Bawden and Sefton-Green, the realistic assumptions in digital literacy were discussed in Chapter 6. These

[73] In Chapter 1, tacit knowledge was briefly discussed in terms of the definition of 'assumption' used in this thesis. It was suggested that, though tacit knowledge is an area of research that could be compatible with this study, the definitions did not quite fit and the word 'assumption', meaning to accept something as true even without evidence, was suggested as the best word to use for this thesis. Tacit knowledge, though an interesting approach, is knowledge that cannot be verbalised or shared, but is personal; this is contrasted with the fact that the staff knowledge of digital literacy, though personal, was shared and articulated for this thesis and that staff were making very similar assumptions in their work.

assumptions were presented first to demonstrate that museums do not only make optimistic suppositions about child digital literacy, and to show that both types of assumptions could be made in the same project. However, the concise nature of Chapter 6 suggests that the museums in this case study are predominately optimistic in their discourse, which was made popular by authors such as Tapscott and Prensky, and in mainstream media, rather than realistic minded assumptions when it comes to child digital literacy. An unexpected finding that came from this research project was the extent to which certain staff at each institution understood realistic and evidenced views of children's digital literacy without directly referencing the studies or readings in which those views are often shared. It suggests that museum staff and design teams have grasped some measure of the discourse that is not as publically available, thereby showing that museum staff display an awareness of current issues in other sectors (in this case media studies) and examine those issues in their own work. It is most interesting that realist discourse could be found in almost all projects undertaken at the three museums, and sat alongside optimistic discourses. Within the data collected, the two diametric views sat side by side within discussions about design, but one or the other view tended to dominate the design process.

The quantity of data discussed in Chapter 7, compared with Chapter 6, demonstrates, there were optimistic assumptions about visitors' digital literacy in all projects presented, and the assumptions fall within the purview of Tapscott's work and Ofcom's yearly reporting on digital literacy levels. Staff at the museums also made assumptions about digital literacy in their interviews that were not directly associated with specific projects. This suggests that, despite the realistic discourse that is apparent in design, it is the optimistic discourses in digital literacy, which come from the public itself and the media, that most dominate museum interactive design. Some staff members, such as Mel Corner at the Herbert, were more nuanced in their understanding between the two opposing views. However, despite these exceptions, most staff encountered through this research, particularly at the NSC, leaned towards expectations of how a younger generation of museum visitors would use digital media that was shaped by optimistic perceptions of child digital literacy. This meant that discussions most often ranged towards the need for digital interactives in the galleries, a focus on making digital interactives enjoyable and entertaining, and a move away from issues such as how understandable and operable the interactive would be for younger children. However,

because of the lack of evaluation studies in all three institutions, developing an understanding of the impact these optimist assumptions had on design outcomes cannot be examined, only supposed.

Ultimately, the main finding from this study is just as surprising as its minor conclusions. As Chapters 6 and 7 demonstrated to us, despite the wealth of data to show assumptions being made in design, there has been remarkably little change in fifteen years across these three institutions and the three production environments that they represent here. Chapter 3 explained how digital literacy theory and understanding have evolved since their beginnings in the last century, specifically though Bawden's work, and how academically we are beginning to come to a confident understanding of how children gain digital literacy and how difficult it is to become 'digitally literate'. Chapter 3 also went into the varied optimistic discourses and suggested that there is also a change there, both in the public's understanding of what digital literacy is, but also in assumptions and expectations of children by members of the public. The changes are noticeable enough in the literature over the last fifteen years. In contrast, the changes in assumptions in museums are not obvious. Indeed, the projects presented in this thesis show that the same type of assumptions about child digital literacy have been made continuously over ten to fifteen years in three separate institutions. This lack of change fails to reflect the change in the field of digital literacy itself, and raises new questions about how museums responds to outside change, as well as change within their own visitors.

This research project has suggested that museums are institutions in the public realm, as they are created for the public, designed for the public, and also exist within public communities. The discourse of digital literacy that dominates in museums is that of public opinion, which is, perhaps, not overly surprising. That, the optimistic view of digital literacy in museums has not noticeably changed in fifteen years is, however, more surprising, especially since this discourse in digital literacy literature has shown an evolution over the same time period.

This lack of change in optimistic views (and also realistic ones) suggests that it is an aspect of museum work that is the root cause of the lack of change in both these opposing views within design assumptions. This study does not aim to explain this

change, or to comment on its impact within the museum now or in the future. Rather, what this study can postulate is that the lack of change suggests that museums are not perhaps responding to the new generation of post-millennials. This lack of response would indicate that museums are possibly not designing for their public as well as, perhaps, they intend to, and are not employing the principles of user-centred design to their fullest. Further research would be needed to endorse such statements with evidence, as, of course, these are conclusions only extrapolated from the evidence gathered in this one study.

What is equally interesting is that the lack of response to post-millennials exists in all three museums, and therefore the different types of digital production as well. The continuity does pose the question that this is a larger issue across all museums (though this cannot be evidenced in this research), and that the assumptions being made are less dependent on museum subject matter, or their use of digital; it could be, rather, a wider comment on museum understandings of their visitors.

What can this research mean for museums? It is possible (though further research is needed on a larger scale to make certain claims) that museums are failing to respond to a key visitor demographic – children – despite purporting to design for them. The research in this study also suggests that, though museum staff and designers (at least those considered here) have acquired knowledge of digital literacy, that is both optimistic and realistic in its views, they make little differential between the two diametric discourses and, as was uncovered during interviews, have given little previous thought to their understandings and where they were acquired. It can be suggested that, as museums are public, it is not unusual for staff to have developed understandings of visitors common in popular discourse (media discourse), but the academic discourse in digital literacy also found in these institutions suggests that staff are acquiring their visitor knowledge from several different sources. This is a comment on museum staff in a much larger sense, and research into how the staff gain knowledge would be another step this research could potentially take, particularly when viewed in light of recent developments in the museum field.

8.2 Other Findings

During the course of this research project, several findings were uncovered that were not part of the direct intention of the research question, but still impacted on the project itself. These findings were uncovered during different times during the course of field research in 2013 and in the analysis of the fieldwork in 2014. Though the findings are side notes within the greater project, they do pose interesting questions in terms of where the research may go next.

8.2 1 Institutional Documentation

The first of these secondary findings was uncovered at the beginning of the data collection phase, when each of the case study museums was asked to provide documentation about previous galleries and interactive designs. It became obvious immediately that each of the museums lacked institutional archive data for even recent design projects, or in some cases could not uncover the data, though staff believed it existed. This lack of data proved an encumbrance during data analysis as it meant there were large gaps, in many cases, in the last fifteen years of the museums and their designs. Because of this lack of archive data on past projects, staff accounts had to be relied upon in greater depth than intended in the original methodology of this study.

It is the historical look back over fifteen years of design in museums that is a unique feature of this research project, as it allows for changes over time to be uncovered and explained in conjunction with children's digital literacy. For this study, the lack of information, specifically relating to prototyping documentation, but also to all other aspects of the design process, meant that there were limitations in the analysis of each museum institution. The gaps in the data required that some projects in the last fifteen years run by the museums had to be left out of this study, as there was not enough documentation in which to uncover digital literacy assumptions.

For the museums, this lack of documentation is also a problem, especially in terms of evaluation of past projects in order to develop better understanding of visitors and their needs for future projects. It became clear over the course of the field research that many staff at each institution did feel that the lack of archival data was a detriment, and some

staff members were surprised to uncover how little archival data could be found about their own institutions. This lack of documented history of a museum (versus a museum's collection) was found in all three institutions.

The importance of archival documentation about museum institutions is apparent in the work of researchers such as MacLeod, Baker and Richardson, and Whitehead. All three of these researchers have relied on institutional data in order to develop a history of museums. In the case of MacLeod (2013), her recent work on museum architecture has made use of documentation surrounding a cultural building's history. For Baker and Richardson (1999), their research has been conducted about the history of the collection of the Victoria and Albert Museum in London, which, though it makes use of collection archives, also deals with institution history and how collections come to be. Whitehead's (2005) work on the National Gallery is a prime example of a history of an institution researched through archival data, as is Wilson's (2002) history of the British Museum. Without archival data, such projects as these and the ability for the museum studies field to look back on the history of institutions, in their many forms, would be severely hampered. For a field with such a long history (formal museums dating back to the 18th century), an inability for current research to look back in time to former practices, projects, exhibitions and designs is an issue not easily resolvable. Already this research uncovered that even projects within the last ten years at the case study museums suffer from a lack of documentation pertaining to their development. This research did not delve into the reasons for this, though current design projects at the NSC, as an example, have come to rely on personal communication and design meetings, rather than formal design documentation. A continuation of a lack of archived documentation on projects and design over the coming years will make research studies such as this one, which looks back to uncover changes over time, very difficult, thus impacting on our understanding of the museum sector and its history.

8.2.2 Evaluation

During the data collection phase of this research, another finding was uncovered, though slightly later in the process than the lack of documentation. The museums in this project all suffered from issues with evaluation of digital interactives. Each of the institutions conducted demographic and statistical visitor studies, but most failed to

demonstrate that more intensive qualitative evaluation was conducted, or evaluation dealing specifically with the digital aspects of the galleries. This lack of evaluation seemed to be something that staff at the institutions understood was not positive, and several staff mentioned during their interviews that they felt more evaluation of past projects would have been helpful, as well as undertaking evaluation of current projects. Yates suggested that it is difficult to evaluate visitors in the gallery after exhibits have been launched because a museum has to concentrate on the next project, and there is a lack of resources to hire skilled evaluators. Elms at the Herbert declared that he felt that there was not enough evaluation of digital, specifically, undertaken in museums. He also felt that evaluation studies that were conducted at other museums were not shared openly, making it difficult for the Herbert to understand other museums' issues and solutions.

Consequently, the lack of evaluation in museums for digital interactives directly poses a problem for future interactive design, as problems and issues with current interface systems may be repeated in future gallery designs and exhibitions due to a lack of understanding. This is seen at WPM which has reused the 'design an…' interactive in several projects without formal evaluation of the system when it originally opened in What on Earth! in 2006 with 'Designed for Life'. Perpetuation of the same problems with assumptions surrounding visitors' digital literacy is too easily repeated without proper evaluation studies to demonstrate those assumptions. Across the entire sector this would impact all museums, whether concerned with digital interactives or other exhibition elements; without proper understanding of how visitors use exhibits, it is difficult to design better exhibits in the future.

For this study, the lack of evaluation meant that there were gaps in the data collected and in the analysis using the four-step design process, as can be seen in Chapters 6 and 7. It is clear that a lack of evaluation has contributed to further assumptions on more recent projects and the perpetuation of several opinions on both optimistic and realistic discourse in digital literacy. Without evaluation of digital interactives, it can be estimated that the assumptions currently made will continue to be made in future projects, and an understanding of visitors' digital literacy will continue to remain a side note in project design amongst the museums presented in this research. It will likely contribute to the continuation of optimistic discourses in interactive design in museums.

8.2.3 Children and the Family

This research project began with the attempt to uncover staff assumptions surrounding children and their digital literacy. However, in the museums that participated in this research, it is clear that 'children' are not entirely their own category, which is supported in the academic literature from such authors as Falk and Dierking who write of the museum 'visitor'. Museums understand that children do not visit on their own; they come either as a school group or as a family group. Therefore there are always adults involved in the visit, at least to some extent. As this project focuses on children (families) who visit outside of school groups – this accounts for, in all three institutions, the majority of visitors – the issue of how the family unit and their association with digital technology must be discussed.

For WPM, the Herbert and the NSC, families coming together to visit the centres are important. 'Inter-generational' was a key phrase used by many staff during the interviews, with the focus being on sparking conversations and engagement between generations. This could be between a young child and a parent, between older children and grandparents, or even between children of different ages. Much of the designs for the galleries at the institutions were centred on encouraging generations to talk and find enjoyment together in their visit. The visit to the museum is therefore not about learning facts regarding history or science, but rather about experiencing a day out together and learning about other members of the visiting group (Travis, pers. comm. 8 April 2013).

The focus on families is also clear in the design briefs from the Herbert and the NSC, where exhibits were designed for family audiences, or for an even wider range of visiting groups, from very young to the very old. As Yates (pers. comm. 31 January 2013) postulated in an interview, it is most likely that the NSC should be designing for ages four through eighty. This is in contrast to the original development of the Centre, which was aimed very specifically at late Key Stage 2. Family groups, however, have become such a key audience, with very young children, that the NSC is adapting to designing for their actual audience. It is about how to occupy and engage the whole family together (*ibid*).

The Herbert also has had a similar approach to the other institutions, where 'families' are the audience, not just children. The staff especially designed for this with the interactives, hoping that parents and children would use them together and converse (Taylor, pers. comm. 15 April 2013). This is reflected in the weekend and holiday programming that the Herbert also runs through their learning department, where activities for inter-generational groups are the main focus, with the hope that visitors will then take those ideas home and spark more conversation after the visit. However, the *Godiva Discovery Gallery* was aimed almost entirely at children. Even so, there was the understanding that children would not be in the gallery space alone, and there are activities that might interest adults, as well as text panels to be read (Herbert Design Briefs).

For these institutions, then, the focus of their assumptions is not entirely (or separately) on children, but rather as visiting groups of different generations coming together and making use of the exhibits together. When staff design exhibits, digital or otherwise, they are designing for children and adults, thereby negating (in theory) issues that might be created through low levels of child digital literacy. In terms of this project, this focus on children with adults using digital interactives has an important impact. Though there have been issues identified in staff's lack of changes in understanding children's digital literacy, in designing for family groups as a whole, digital interactives that require high levels of digital literacy can be operated by adults in conjunction with children, not relying on children to operate such technology on their own. It is therefore, in many of the projects discussed in this thesis, left to the parents (or other adult guardians) to understand and make use of the interactives on behalf of their children and to develop their child's digital literacy. Lastly, when we look at this understanding of family visitors in museums, it is important across the entire museum field, not just with digital interactive design, and impacts at all levels of how museums create themselves for their visiting audience.

8.2.4 Production Models and Design Processes

In terms of the three case study museums, the types of production model were explored after case study data had been collected, in an attempt to understand if the way museums designed digitally would affect the data of optimistic and realistic views of digital literacy. Staff at the museums had involvement in the design no matter which production model was used for a project; however, and importantly, it is the amount of this staff contribution that characterises the production models discussed below. 'In-house' therefore having complete staff involvement, while 'outsourced' where staff are involved mainly in regards to their understanding of the collections and their visitors, not in the process of design of the actual interactives. However, in terms of simplifying Chapter 5 and the focus on the case studies, including production models and the accompanying theories, this discussion is contained here within the conclusion. It is felt that this discussion (covered in brief below) is something that could be explored in further depth, and lead to an understanding of how production model affects the final outcome of a digital interactive and the assumptions made in the design.

Models of production are appropriated from JISC Digital Media[74] and were originally created to explain the process of digitizing collections (JISC, 2014).[75] The terminology is equally applicable to digital media meant for exhibition, however. More academically, Kasra Ferdows' chapter in *Strategy, Innovation, and Change: Challenges for Management* speaks about production networks for global companies and degrees of outsourcing (from fully 'outsourced' to a more balanced 'hybrid' approach) (2008). The terminology of 'outsourced', 'in-house' and 'hybrid' are therefore also common in the business sector of production. When digitizing, 'outsourced' is taken to mean that the whole digitizing project is given over to another company who specialises in such skills, which also means putting trust in the company to care for the objects being digitised, as well as the final end product that will be used by the museum outsourcing the project. 'In-house' therefore allows a museum to keep control of their objects, but also to develop skills during the digitization project, and rely on their own developed knowledge of the collection (JISC, 2014). Ferdows (2008) work, though in the business and management sector rather than museums, supports these interpretations where

[74] JISC Digital Media is a UK government-funded information technology agency
[75] Found at: www.jiscdigitalmedia.ac.uk/guide/to-outsource-or-to-digitise-in-house

projects are concerned, but offers the 'hybrid' approach as a way to balance these, ensuring that the company (in this study a museum) maintains control of their content, while making use of the skill of outside companies for a specific project.

In terms of the NSC, the production model was, after the initial Centre was completed and opened to the public, very much an in-house design model. NSC Creative has been able to undertake the design and updating of exhibits since 2001, though this has only become a formal role for the design company since 2008. During the redevelopment of the 'Sun, Earth, and Moon' exhibit, NSC Creative was able to play a large role, taking on not only the design of the interactives, but their development as well, through the four-step process.

At the Herbert, staff have been involved, using their expertise knowledge of the collections and their visitors, throughout exhibitions in the last fifteen years. This hybrid model shows a meeting of staff knowledge, coupled with expertise of outside design companies to handle the technical aspects. It has worked for the Herbert, in that they have been able to use their own knowledge to bring to the design, while ensuring that the digital interactives created during the redevelopment would be made to the highest standard possible. Also, within the Herbert, is the Herbert Media department, which have been able to undertake occasional examples of in-house design, such as the interactive in the *Secret Egypt* touring exhibit. However, a limit of resources and staff skills has meant that this sort of in-house production has been infrequent.

Finally, at WPM, staff have been designing more along the lines of the outsourced model of production, owing to a lack of resources and skill. An outside design company undertook to create the redeveloped galleries, though staff were involved in terms of their understanding of the collections and information included in the exhibits. As few long-term staff members were available for interview during this study, it is difficult to understand the level to which most staff had involvement in the digital designs specifically. However, unlike at the Herbert, one particular staff member, Alistair McLean, was highly involved in the interactivity, to the extent that his role was more of an in-house design model; he created and wrote the programme for the 'Designed for Life' interactive.

As mentioned in Chapter 5, on the level of the overall design process within the different types of museums (specifically the four-step process examined in this research as a structure form of analysis), there is future research that could be conducted in understanding where the digital literacy assumptions are made, and what impact this has on the overall digital design. For example, are assumptions usually made in the requirements stage, rather than later on? And if so, does this have a greater impact on the finale design, then assumptions made in, for instance, the prototyping stage? This is research that is only touched upon in this thesis, as the case study data does suggest that more assumptions can be found in the earlier design stages, and it can be postulated that these assumptions perpetuate throughout the design and impact the latter stages of the process (perpetuating the assumptions to the end of the project).

8.3 Limitations of the Research

With any study of this size, there are limitations in what the research can focus on, from the methods used for data collection to the research questions asked. This research project is necessarily small, including only a few museums in a central area and a specific segment of visitors, research data and a two-part research question. The limitations within this study have allowed for a specific question to be researched in depth and presented in this thesis, but those same limitations must also be acknowledged within the wider field under which this project falls.

This research uses only three museums in central England, as the methodology section in Chapter 1 explained. The main reason for this limited number was to ensure that an in depth historical approach to data collection at each institution could be undertaken in the limited three years of the PhD project. This in depth approach allowed for the assumptions of staff to be analysed on a number of projects over a long time frame to ensure the research question was answerable.

However, with the limit of institutions presented here, and the small geographical area in which they reside, wider opinions on assumptions in digital literacy in UK museums cannot be made without further research. The conclusions for this research project are only true within the institutions presented here. As well, theories about the types of institutions cannot be made for the same reason, as the NSC, WPM and the Herbert

represented only certain types of museums (for instance, an art gallery was not included in this study). Once again, conclusions can only be made about and between these three cultural centres. It is entirely possible that different conclusions (and different assumptions) would have been uncovered at other museums, or in other areas of England.

A larger case study of more institutions would have allowed for more firm conclusions to be made and perhaps uncovered a more obvious change in assumptions. More institutions would also have allowed for a more defined understanding of the subsequent finds such as lack of documentation and evaluation. It is always possible that the three institutions that were included in this study are not typical of museums in England, which is why no firm conclusions outside of the museums presented here have been discussed.

As well as the limitations to this small study which are discussed, there are several questions that could be raised regarding what outcomes would have been uncovered if the study had looked at other questions or the research question had been approached from a different angle. This is especially apparent in that this study chose to review staff assumptions about visitors, and did not look at the visitors themselves beyond observational (anecdotal) studies in the galleries. To look at the visitors instead (or as well as) would very likely have provided different views than this thesis presents, and different conclusions as well. This study looked at how staff viewed visitors' digital literacy, but did not seek to understand visitors' actual digital literacy and digital engagement. This last, the digital engagement, would be of particular interest. The question has been raised in Chapters 6 and 7 of whether some of the issue with how visitors use digital interactives can be down to their level of interest and desire to engage, rather than a deficiency of digital literacy. This is a topic that is in need of exploration (as it was limited in this study that looks at the digital literacy reason) and from the visitor perspective specifically, to uncover just how much of the lack of engagement is from a lack of digital literacy and how much is a lack of interest (or if there are other reasons besides).[76]

[76] It is possible that the deficit model may be of use here in future research. The deficit model, originally developed by social scientists as a way of viewing public understandings of science, was a belief that suggested that the public skepticism with science was because of a lack of knowledge,

Also of direct impact on this project was the decision to review only child digital literacy, not digital literacy of the whole audience, so that questions asked of staff were specifically about family audiences. As such, staff rarely discussed their opinions of adults specifically, but rather as adults visiting with children. No doubt a project that researched adult visitors on their own would uncover different data, as the focus here was on understanding the digital literacy of a new generation that has grown up with technology, rather than adults that have come to technology later in life. It is possible that there would be evidence in adult literacy that compared with children's literacy. The research project would have needed to uncover academic and popular understandings of adult digital literacy, which is less a focus of either area of academic research, and to have used different ways of looking at the data to understand the impact on the case study museums. It would likely have meant that different museums would have been chosen, and perhaps those with a more art-centred collection and therefore more adult visitors.

This study dealt with digital media within the gallery (whether permanent or mobile) and did not look at technologies that could be used out of the museum or at offsite media such as websites. Looking at out of gallery media would have posed a challenge for observing visitors' use, but should have followed a similar methodology in collecting assumptions from staff. It is interesting to note that, while researching this project, it was discovered that fewer staff members are involved in out of gallery digital interactives (especially websites), and so this would likely have limited the staff interviewed for the project and the amount of data uncovered. Looking at offsite interactives might also have proved a challenge to researching children's digital literacy, as mobile platforms and websites would not always be designed specifically for one segment of the visiting population.

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and that, if the public were properly educated, the deficit would change (i.e. the public would change their minds about science) (Dickson, 2005). However, this model contains flaws in its reasoning; mainly that increasing public knowledge will not automatically make the public more enthusiastic about science technologies (*ibid*). However, further study might suggest a newer and more useful model, as several new versions of the deficit model have been suggested in various fields, particularly education.

Lastly, a different cultural setting, most specifically in a different country would have impacted on the data and conclusions of this study. It is possible that the realistic versus optimistic discourses in digital literacy are most apparent in the UK. However, some of the research presented in the theoretical chapters of this thesis did come from the USA and other countries, and therefore suggest similar digital literacy issues in other places around the world. Different cultural industries and methods of design and production in other countries would, however, have had an impact on assumptions made by staff, based on different backgrounds and different institutions.

The findings from this study must be taken with a note of caution. It is not the intention to suggest that museums are designing digital interactives in inappropriate ways or even that they are failing to understand their visitors. Instead, the research in this project was designed simply to understand what museums are doing with digital interactive design for a specific visiting audience and the influences on that design within the theory of digital literacy. Several of the projects in this study have shown that, even interactives designed with seemingly incorrect assumptions can be very popular with visitors (ex. 'Designed for Life'); it cannot be said that museums need to, at this moment, rethink their process and their assumptions. However, what is important from these findings is the comment on how museums see their visitors, how they understand them and design exhibitions for them. If the goal of museums is to provide an educational, enjoyable and interesting visitor experience to local (and further) communities, then designing an appropriate level of use for that experience is key. This research must first take a next step into further study in order to better understand how design assumptions play out in gallery spaces, particularly with a focus on visitors, before conclusions can be made of whether museums are designing correctly or incorrectly and what impact this has on the visitors themselves.

8.3.1 Future Research

This study provides only a starting ground for further study and debates surrounding museum design and technology. It is only the first step towards developing a nuanced understanding of how visitors use and appropriate technology within museum galleries, and what impact digital literacy has on that use. It also provides a start of a discussion

on how much museums truly understand their visitors (beyond demographics) and the importance of evaluation and shared research on future practice.

This study shows the importance and value of considering how younger visitors in multi-generational groups make use of exhibitions and moreover how they use exhibitions geared towards different age groups. This is not a new body of research, as such authors as Dierking (1989) have written on the subject as early as the 1980s. Although as more recent research shows, the focus is still on learning in the museum amongst the inter-generational groups (Borun, Chambers and Cleghorn, 2010). Research has also previously focused on interactives exhibits and family groups (Sandifer 1997; Allen and Gutwill, 2010). However, from this research project we can begin to delve into the idea of whether digital interactives designed for adult visitors provide engagement for young visitors and vice versa, for example. This study provides a theoretical suggestion of where the research may go next, by introducing digital literacy and its current issues (which are varied, but important in the field) and demonstrating how museum staff and designers appropriate these.

The next step in this research would be a wider case study involving other institutions, as well as other types of institutions (art galleries) across England (and then across the UK) to uncover if there are similar conclusions that could be made on a wider scale. As well, looking further back in the research to museum exhibition design prior to the introduction of technology might provide an understanding of the changes that have been made in assumptions about visitors before digital interactives were introduced. This could suggest (if there has been change) that the lack of change since the introduction of digital in galleries is a larger issue that must be addressed.

As has been said, research that also explores the contributing factors to how visitors engage with digital interactives would be key as well. Digital literacy is only one reason that a visitor might not seek to use a digital interactive (or not use it in the way it was designed). However, although it is only one reason, it is an important one, as lack of engagement can be seen to stem from lack of understanding, particularly when a visitor attempts to use an interactive, but does not succeed in the way the designer intended. This is, however, research that should be explored from the visitor point of view, to see

their reasoning and to understand how they do or do not engage. This could then be approached once more from the museum staff view of their visitors' engagement.

This research would also benefit from a study in several museums that are able to make available more archival documentation about past projects, or more detailed information to see if the lack of change in assumptions concluded from these case study museums is, rather, because of a lack of evidence and not a lack of change. Providing another study that comes to similar conclusions would give evidence that a lack of understanding of museum staff about digital literacy is a fault on a wide scale that should be investigated in the future.

Further research into the issues presented in this study would, no matter the outcome, lead to a deeper understanding of visitors, their habits, needs and abilities and how museums seek to engage visitors within gallery spaces, as well as commenting on the wide appropriation of technology by the cultural sector.

8.4 The Contribution Made by this Research

Significantly, a thesis must contribute to the larger field of study in which it sits. For this research, as Chapter 1 introduced, there are a number of fields upon which this project draws and therefore a number of contributions that have been made, particularly in a multi-disciplinary way.

8.4.1 Museum Studies

This project was undertaken at a museum studies department, and thus the background to the research comes from both museological work as well as academic research into the study of museums. However, museum studies is a multi-disciplinary field, which draws from a number of other areas of culture and study. In this research project, the main disciplines that are combined are museum studies and digital literacy (through media studies as the wider field). This particular combination of fields of study is not unique in the academic world, particularly in areas such as Denmark, but it is still a

very new concept.[77] The particularly unique aspect of this research is the view of optimist and realist discourses in digital literacy and their similarities and stark differences, and what impact these have had on the development of the field of study that is digital literacy. Bringing this discussion into museums to enquire as to what place digital literacy holds in the museum (and whether it holds any place at all) was the main foundation of the research question.

In this research, museums serve as a case study in order to better understand how a specific segment of the public (museum staff) view digital literacy. The conclusions from this project suggest that there is little understanding of digital literacy, which is perhaps not surprising from a museum staff member who is not academically trained in the specific field of media studies. However, what is interesting in the conclusions is that it is the optimistic discourse of digital literacy, the understanding that does not come from academic research, but rather from common assumptions[78], that holds most apparent amongst museum staff and upon which they base their own expectations in the design of digital interactives. The combination of museum studies and digital literacy in one project suggests that there are further ways in which we can understand our visitors beyond visitor studies.

In museology (specifically visitor studies), a key discourse has lately centred on the concept of 'participation' (Simon, 2010). As a field of study, we speak of participatory institutions and exhibitions, and of working alongside the public in the creation and maintenance of local museums. Yet, participatory culture relies on working closely with the public and therefore – it can be assumed – understanding the public.[79] This study suggests that some museums are not yet at this stage, and in so doing, it suggests that there is a complex relationship between design assumptions and visitor provision. Visitor studies surrounding 'participation' could benefit from unpacking this relationship further, as this thesis has attempted to do in the case of digital design. We

[77] See Kirsten Drotner and Kim Schrøder's work from Denmark and Russo, Watkins and Groundwater-Smith, 2009 from Australia.

[78] In the introduction these common assumptions were explained in terms of 'tacit knowledge'; knowledge that a person has but cannot communicate (or is not always aware they have). However, the assumptions made in this thesis have been shared and articulated as part of the research, which suggests that digital literacy understandings in the museum are not strictly tacit in approach.

[79] For a discussion surrounding how museums become participatory, with a specific focus on designing for participation, see Chapter 1: Principles of Participation in Simon's *The Participatory Museum*.

also speak in academic discourse about the responsive museum, which depends on the conceptual idea that museums are seeking to meet the needs of visitors from a wide range of backgrounds and positions (autism in museums has become especially topical in recent months during the writing of this thesis, though with little research in the academy as yet).[80] To be a responsive museum[81] means that an institution needs to responds to visitors in – almost – real-time; to be able to understand current issues amongst visitors and enable the museum to respond to those issues as quickly as possible (Lang, Reeve and Wollard, 2006). *Reinventing the Museum*, published in 2004, discussed issues that were even then becoming apparent in how to make institutions relevant to their publics. Though the book contains articles about the role of the visitor, it is foremost about the role of the museum. It questions what museums can achieve, and what they can do for the complex communities in which cultural institutions exist (Anderson). This concept is, hopefully, a direction museums will continue to follow, but the institutions in this study suggest that museums are still a long way from becoming 'responsive' institutions, at least where digital interactivity and digital literacy are concerned.

8.4.2 Methodology

A novel contribution of this project is through its methodology. Though the combination of interview, document analysis and historical evidence is not original in a research project, particularly in the cultural sector,[82] it is the fact that the methodology focused significantly on a historical approach to a current issue that is the main contribution. Digital heritage is a topic well reviewed in academia, particularly in association with museum studies,[83] however it is very infrequently a field that looks backward with as much importance as it does forward. The focus of this project that traces the last fifteen years of design in museums is a way to view digital heritage as

[80] The current campaign to instruct museums about best practice for autistic visitors is headed by the Autism in the Museum website: http://www.autisminthemuseum.org/ and is focused on making cultural centres accessible and welcoming to autistic learners and their families.

[81] The Responsive Museum: Working with audiences in the twenty-first century is a suitable work to reflect on the ideas of responsiveness up until the last decade. Though the literature in the book is optimistic, how far museums are responsive and how responsive they realistically need to be is an area also called into question by several authors within the volume. Particularly relevant for this study is Chapter 4: Prioritizing Audience Groups by John Reeve.

[82] Christianson, M.K., et al, 2008; Palmer and Knutson, 2005, and outside the cultural sector see Welch, 2014.

[83] Parry, 2010; see also research by Konstantinos Arvanitis at Manchester and Areti Galani at Newcastle.

historical, something that already has a history that must be understood in order to better research the present and design for the future. To view technology in museums as something historical seems contrary to optimistic discourses, however though technology in museums is still recent compared to the longer history of museum institutions, it is still established enough to warrant a review of past practice, namely the use of technology in museum design for this project.

The use of institutional data from the case study museums is also part of this methodological contribution. As the conclusions to Chapters 6 and 7 demonstrated, there is already an issue with using such data for a historical study, because of the lack of data kept in these museums. Relying upon such sparse research can create limitations in a research project, however, in many cases such research is the only possibility in order to uncover past practice. In the case of the museums presented in this study, staff recollections of very early projects in the fifteen year cycle were almost non-existent in the case of WPM and the NSC. Only at the Herbert were there staff that had been involved in the original gallery redevelopments and could remember a time before digital was introduced. At the NSC, the staff were not involved in the Centre's development and so could only comment on the galleries after their designs were in place, as well as more recent projects. For this particularly case study, it was the early documentation from HSD on which the research relied, but had this documentation not existed (any longer) it would have caused a severe detriment to understanding the original interactive design of such a digitally enhanced institution. At WPM, only a very few staff were still employed who were directly involved in the original redevelopment in the mid-2000s, creating gaps in knowledge of how interactives in several of the galleries were constructed. Without the institutional data that was uncovered, the gaps within the staff interviews would have been larger, particularly for the earlier part of the fifteen-year history presented here.

8.4.3 User-centred Design Theory

UCD within museums is itself not a novel link.[84] The design of digital interactives has previously been studied, though most specifically for mobile technologies (see Vavoula, for example). The unique aspect to this study is how UCD is used within the research. The main purpose of UCD is less to understand how digital interactives are designed but rather to use the theory behind UCD in order to organise and structure the analysis of the data collected. This unique appropriation allowed for digital interactive designs in three separate institutions to be understood on a similar level, by looking within the design process to uncover assumptions at each level. The assumptions could then be understood to have changed, or not, within each institution, but all three institutions could also be viewed together. Thus the conclusion that there has been little change across the museums can be made. Though this does not, as the limitations section in this chapter describes, mean that assumptions about change in all museums can be made; it does suggest that the lack of change is not unique to only these case studies.

In this project, UCD was researched originally to understand the concept of design that is most often used in the professional field to create digital. However, the field research discovered that no two museums use exactly the same process and in fact are most likely to appropriate their own version of UCD based on their exhibitions and staff skills. However, all the institutions in this study did follow the basic premise of the four-step design process, identified in Chapter 4 from Rogers, Sharpe and Preece. This allowed, during the analysis of the data, to uncover different production model examples that seemed most typical in museum institutions. The conclusion of these case studies as examples of the most typical forms of production models in cultural institutions came from the analysis, and was not an expected outcome. However, it was this discovery of production model examples that lead to the structure of the later thesis chapters and allowed the museums to be compared to each other through their design processes (the four-step design). The realistic and optimistic assumptions of digital literacy could be found in each step of the design, and understood through the type of production model of the institution in which the assumption was made. This specific

[84] Hertzum, 1998; Silvers, Wilson and Rogers, 2013; Erminia, et al, 2008; and Silvers, 'Design Thinking for Museums' website.

way of looking at digital design in museums suggests a way to continue research in this vein in future, and is not dependent on a historical overview of past projects; rather, ongoing projects could be reviewed during each step of the design and assumptions understood and corrected as a way of undertaking summative evaluation during an iterative design process.

8.5 Future Proofing the Post-Digital

Overall, this study has sought to understand what assumptions museum staff and designers make during the design process of creating a digital interactive for use in museum galleries. It has accomplished this by reviewing three museums within England who have designed digital interactives over the last ten to fifteen years. The aim of the project was to uncover what changes had been made in the assumptions throughout a number of projects over the last decade to understand if staff assumptions reflected the outer change in digital literacy theory. The thesis did this by reviewing the design processes of each museum, understanding where assumptions were made so as to compare them across the three institutions, and to reflect on subtle changes in opinions of staff that adhered to either realist or optimist views of children's changing digital literacy. Ultimately, what was uncovered suggested that despite a generation of technological and demographic change, and despite changes to how the academy has understood digital literacy, the assumptions made by these museums remained constant. And furthermore, that, rather than informed by emerging academic discourse (the sort to problematize and evidence the complexities of child digital literacy) the discourse and practice seen in these museums was shaped instead by a more optimistic discourse (that, in contrast, has tended to overstate and oversimplify the digital competencies of the post-millennial generation).

This research project represents a piece of research that is multi-disciplinary between the field of museum studies, media studies and interactive design (UCD). It has attempted to show the value in asking precise questions about digital in museums at a time in the academic and public communities where digital has become, not a matter of the future, but an issue of the present. 'Digital' has, to some extent, become 'post-digital', and research that is able to reflect on digital as a practice that already has a history will be important for our future understanding of what has come before; the

ability to reflect on practice in an ever-changing world. We are at a time when we can look backwards to understand how we came to this moment, to reflect on how and where changes have occurred in museum digital practice and if there has been continuity or great change. And, in this way, this study, at one level, stands as a demonstration of how the way we write about digital in museums is changing.

Consent Forms

For Museum Staff:

Informed Consent Form for one-on-one staff and designer interviews in museums for the project titled 'Designing for the Post-Millennials: Can we evidence a change in digital interactive gallery design for children since the turn of the millennium?'

Amy Hetherington
University of Leicester

This Informed Consent Form has two parts:
• Information Sheet (to share information about the study with you)
• Certificate of Consent (for signatures if you agree you will participate)

You will be provided with a copy of this form.

Part I: Information Sheet

Introduction
I am a PhD student at the University of Leicester in their Museum Studies department. I am doing my thesis research on the how museum gallery design using digital technology in the exhibit has changed over the last 14 years. Has the change kept up with the changing forms of technology and the changing digital literacy of children who are more exposed to a wider range of technology? I am interested in what the change is, how it has come about, and how visitors, specifically children, have influenced that change.

I hope you will be willing to participate in this study as an independent person.

Purpose
This topic has not been asked in academia previously, but an in-depth study at a number of UK museums to chart the change in design practice, process and the use of technology-based exhibits will help to understand how museums themselves are changing and the interior and exterior influences that have characterised that change. Also, how fast has exhibit design changed and the implementation of technology-based interactive exhibits in a range of museums and what has accounted for that pace? Ultimately, this study is focuses on the point of view of the museum, as most studies focus on the visitors themselves. I wish to give museums a voice in the study of visitor impact on gallery design.

Type of Research Intervention
One-on-one interviews.

Selection of Participants
You have been given this form because you have already stated an interest in assisting with this research. You were chosen because you are involved in interactive design in

museums in the UK in some capacity or have similar experience with digital interactives in museum galleries.

Voluntary Participation
After reading this and discussing the contents we me, you do not have to participate. You can choose to say no, at which time I will have no further contact with you. If you decide to participate, we will engage in a one-on-one interview that will last between half an hour and an hour.

Question Types
The questions I will ask will depend on your role in technology driven interactive design in the museum gallery. However, most questions will centre on your role, previous projects you have worked on, current projects that you have involvement with and your thoughts on the future of gallery design with interactives. A list of proposed question accompanies this consent form.

Confidentiality
The interview will be digitally recorded for later transcription, but all information will be kept confidential. The interview will be transcribed at a later date and sections will be included as part of the appendix to the thesis. You will be identified by your name and company. However, it is your decision to agree to your name and company use.

Sharing of Research Findings
At the end of the study, I would be happy to share my findings (as well as the published thesis) with you for the benefit of your work. If you would care to have this information sent to you, it will be done via the email contact you provide at the interview.

Right to Withdraw
You may choose not to participate in this study. However, choosing to participate does not mean you cannot later withdraw your participation. You may do so by contacting me up until March 2014. After this time, the information you have provided will already have been used to write my thesis and will make extraction difficult once analysis is complete.

If you have any further questions or concerns or would later like to withdraw your consent, you may contact me [redacted] or [redacted].

Part II: Certificate of Consent

Certificate of Consent
I have been asked to give consent to participate in this research study which will involve completing a private interview. I have been informed of the purpose of this study and what the information I provide will be used for. I understand that by participating I acknowledge that my information will be used in a published manuscript.

I have read the information provided. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participant in this study and understand that I have the right to withdraw my consent from the study up until March 2014.

- I consent to the use of my name/company in the published thesis **YES / NO**
- I consent that what I say in the interview may be quoted in the published thesis (in context) **YES / NO**
- I consent to the interview audio being recorded **YES / NO**

(If you circle no, your comments will referenced anonymously. Your name/company itself will not be used.)

Print Name of Participant _____

Signature of Participant _____

Email Address _____

Date _____
Day/month/year

I have accurately read or witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of researcher_____

Signature of researcher _____

Date _____
Day/month/year

A copy of this Informed Consent Form has been provided to the Participant _____ (initialled by researcher)

For Parents and Children (Pilot Study):

Dear Parent/Guardian

Re: Project – **Playing with Computers in the Museum**

My name is Amy Hetherington and I am currently undertaking a doctorate at the University of Leicester. I am doing a project about how young people use computer based technologies at home and in the museum.

You have been approached because you are visiting the museum today with your son/daughter/children who are between the ages of 7-13. I would really appreciate your help with this project by answering a short questionnaire about your visit to the gallery. I would also like to follow you on your visit to the museum to observe how your child uses the technologies in the gallery. I will not interact with you in the gallery, only observe.

The answers you and your child give will be recorded in written notes. The interviews will not be digitally recorded. The answers you and your child(ren) give will be kept confidential. I will identify the children I interview only by age and gender. No one will be named in the report. The information I gather from you and your child will be seen by myself and my supervisor(s) who will be checking my work. After this, I will publish my thesis and it will be available through my university library, so that other students and researchers can see my work. I will also publish a report and/or journal article using the data I collect during my work at the museum. Again, your name and your child's name will not be used anywhere outside of my own research notes which will be seen by myself and my supervisor(s) only.

I plan to use this information in my thesis to look at how children, who regularly interact with technology at home and in their daily lives, engage with the technology provided in the museum gallery. Very little research has been done on this and museums need a better understanding of what sorts of interactives and computer-based programmes children would enjoy best on their museum visit.

If you are happy to take part, I would be very grateful if you could sign the attached form and return it to me. You will have a copy of the form to keep.

If you change your mind about your involvement in this project at a later date you can email me at [redacted] up until August 2013 to ask that I remove your data from my research. You will be assigned a number today. It can be found on the top corner of your signed form. If you wish to withdraw, this number will assist me in locating the correct data.

If you have any questions about the research ethics involved in this project that uses children's data, my department has an ethics officer ([redacted]) you can contact at [redacted].

Many thanks for taking the time to read this letter and for your help.

Amy Hetherington

PART I

I (print <u>your</u> name)……..…….. am happy to take part in the project "Playing with Computers in the Museum".

- I agree to allow the researcher to ask me questions about my child's computer use and our visit to the museum. I agree to allow the researcher to ask questions of my children about their visit to the museum.
- I accept that the interview answers will be recorded on paper.
- I understand that the interview data will be confidential and will only be seen by the researcher and their supervisor(s).
- I understand that I and my children will be identified in the research only by gender and, in reference to my children, their age, but no names will be included in the completed report. I do understand that the data collected today will become part of a publish thesis in the future.
- I understand that I can stop the interview at any time.
- **I understand that by signing this form I consent to allow myself and my children to participate in this study.**

Your Signature_____

Please print your children's

names_____

Date_____
day/month/year

Please keep a copy of this form for your records.

A copy of this Informed Consent Form has been provided to the Participant _____ (initialled by researcher)

I have accurately read or witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of researcher_____

Signature of researcher _____

Date _____
Day/month/year

APPENDIX B

Pilot Study Survey and Observations

Survey

'Playing with Computers in Museums'
Parent/Child Survey

Could you please answer the following questions **together** to the best of your ability?

Child(ren) age and gender:

What sort of technology do you have in your home? (Please circle)

(a) touch screens (desktop, iPad, iPhone, tablet, smartphone
(b) traditional computer with keyboard and mouse or traditional laptop (or both)
(c) no computer technology at your home
(d) video game equipment

Which of the technology above are the child(ren) allowed to use for *play* (rather than solely school-related work)?

Which do your child(ren) use most often of the technologies above for play-like activities?

Which does your child(ren) like to use the most (please let them answer this).

Do you feel your child(ren) understand how to use technology or do you need to show them if they encounter a new type (such as a touchscreen if they have never used one before). Do you feel your child(ren) are digitally literate and understand technology at a good level for their age?

Do you think museum galleries should include technology and tech-based interactives? Ex. touch-based information screens.

Do you feel the digital interactives in the Dinosaur and Geology gallery adds to the learning experience about dinosaurs and geology?

POST VISIT – Answer after you have left the gallery

What part of the gallery did your child(ren) like the most? (You can ask them what they liked.)

If they used any of the interactives, do you feel they understand their purpose and relevance to the exhibit or did they seem to just 'button push' and not engage with the information content of the interactive?

Do you feel that using the interactives made for a better visiting experience to the gallery? Or, would the experience have been the same without the interactives? Do you feel that they added to the enjoyment your child(ren) experienced?

Observation Questions for Pilot Study

1) How did the children move through the space?
2) How did the children approach the interactives?
3) Does age/gender have an effect?
4) How long at the computers? In the whole gallery?
5) Did they use the non-digital interactives?
6) Did they engage with the text/panels and objects?

APPENDIX C

Project Chronology

National Space Centre

Space Now redevelopment 2006-2007
- Interactive Table, 2007

Rocket Tower redevelopment 2008/9

Planet Earth gallery redevelopment 2010
- 'Weatherpod' (originally 'TV Weather Studio'), 2010

Looking Up gallery
- 'Destruction of the Dinosaurs' interactive, 2001
- 'Sun, Earth and Moon' exhibit, 2013
  - SOHO Interactive, 2013
  - Google Earth table, 2013
  - 'Today's Sun', 2013

ISS interactive redevelopment, 2013

The Herbert, Art Gallery and Museum

Elements gallery development, 2003-2008

Discover Godiva gallery development, 2003-2008

History gallery development, 2003-2008
- 'Coventry Time' interactive, 2007/8
- 'Digging for Victory', 2007/8

Secret Egypt exhibition, 2010
- 'Real or Fake' interactive, 2010

iPad Application, 2013-2014

Weston Park Museum

What on Earth! gallery development, 2006
- *History Lab* exhibit development ,2006
- 'Designed for Life' interactive, 2006

Arctic World gallery development, 2006

Treasures gallery development, 2008-2010

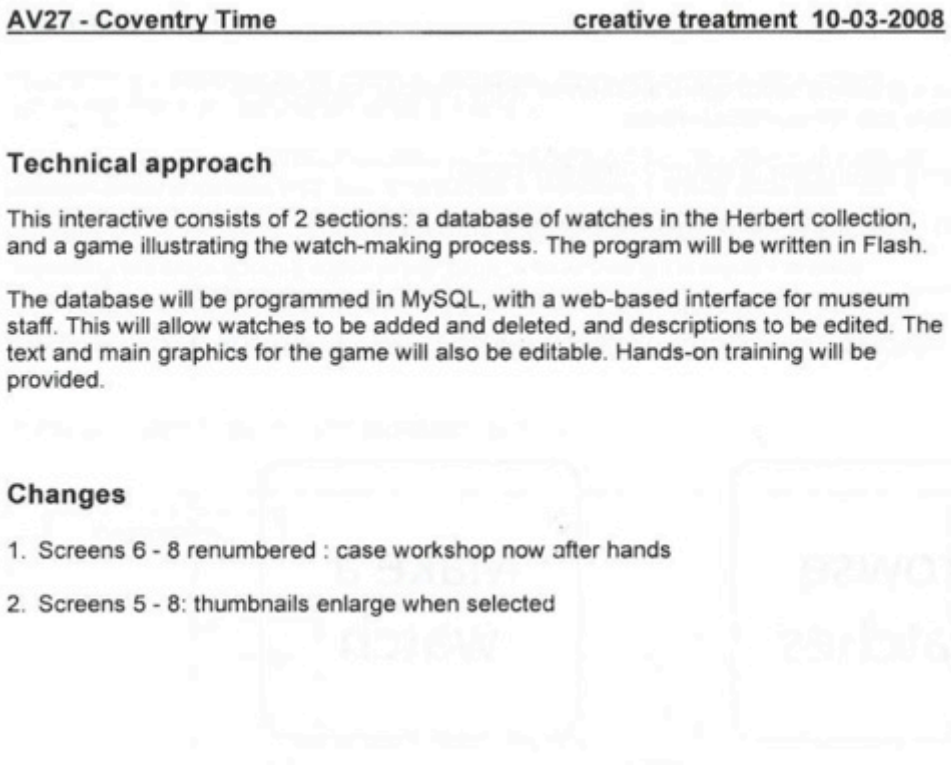
The Big Bug Show exhibition, 2009

Sports Lab exhibition, 2010/11
- 'Design an Athlete', 2010

iPad Tour, 2013-2014

APPENDIX D

Design Documentation



AV27 - Coventry Time **creative treatment 10-03-2008**

Technical approach

This interactive consists of 2 sections: a database of watches in the Herbert collection, and a game illustrating the watch-making process. The program will be written in Flash.

The database will be programmed in MySQL, with a web-based interface for museum staff. This will allow watches to be added and deleted, and descriptions to be edited. The text and main graphics for the game will also be editable. Hands-on training will be provided.

Changes

1. Screens 6 - 8 renumbered : case workshop now after hands
2. Screens 5 - 8: thumbnails enlarge when selected

Appendix D: 'Coventry Time' Interactive Design Brief, Herbert, page 1.

2. Browse watches

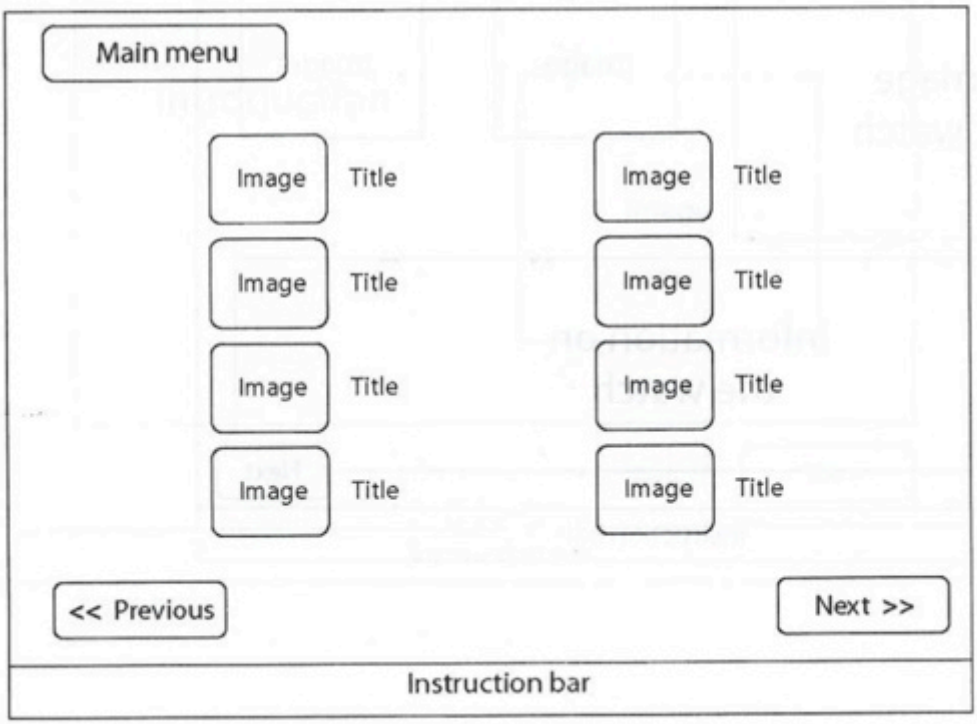
This menu is a database-generated list of watches. There will be about 20 watches featured at first, with more being added in future.

Each watch will be represented by a thumbnail image and a title. The title could include the manufacturer's name and date, where known. Selecting a watch leads to screen 3 (Individual watch).

The menu will show about 8 watches per page, with arrows or Next and Previous buttons for stepping between pages.

The 'Main menu' button leads to screen 1 (Main menu), and is present on all subsequent screens.

Instructions read "Select a watch to find out more".



Appendix D: 'Coventry Time' Interactive Design Brief, Herbert, prototype mock-up, page 2.

AV27 Build a watch

Generally – we think it needs to be a bit jazzier and brighter to appeal to a younger audience – as the content has developed we feel that the target audience has got younger.

We have supplied too much text – we will edit it down and send revised text.

Screen 1

This needs an image of a watch – one of the ones supplied for the browsing section.

The title should be centralised.

The text will be edited down and some general instructions for the game added.

Screen 2

The image on this screen needs to be of an unfinished movement (image no covgm_sh1987_47_10).

The title should be the watch movement. The title should be centralised.

The text will be edited down.

Screen 3

The title should be 'the watch movement'. The title should be centralised.

The text will be edited down.

The instruction at the bottom needs to be touch a movement to find out more

Screen 4

The title should be 'the watch movement'. The title should be centralised.

The text will be edited down.

Change 'chose this mechanism' to chose this movement'

Appendix D: 'Coventry Time' Interactive Design Brief, Herbert, prototype description.

The dial has the hours and minutes marked on it. It was made by one worker and painted by another.

Look at the dials and choose the one that you want.

Pop up info
Most Victorian watch dials had Roman numbers on them. *(covgm_sh watch dial A 1.jpg)*

Dial painters used a glass jar filled with water to magnify the light from their candle. *(covgm_sh watch dial B 2.jpg)*

The finest details on dials were painted with a brush which only had one bristle. *(covgm_sh watch dial C 2.jpg)*

Most watch dials were made of enamel. Enamel is made of powdered glass which is heated in a furnace. (*covgm_sh 1989_139.jpg*)

Images: 4 dials (covgm_sh 1989_139.jpg; covgm_sh watch dial A 1.jpg; covgm_sh watch dial B 2.jpg; covgm_sh watch dial C 2.jpg)
Exterior watch workshop (huw_20061219_006.jpg)

Dial screen 2

The hands

You now need hands to show the time.

Watches usually had three hands to show hours, minutes and seconds. The seconds hand was sometimes in a separate dial on the watch face.

Look at the hands and choose the ones that you want.

Images: 4 sets of hands

Case screen

The case

You are now in a case maker's workshop. You need a case to protect the mechanism of your watch.

Several workers made the different parts of the case. It was made of gold or silver. Many cases were engraved with decorations.

Look at the cases and choose the one that you want.

Pop up info:
This case is made of gold. The case maker did not waste any gold – small offcuts were saved, melted and re-used. (*av27_covgm_sh2004_87_3(2)_cutout.psd*)

This is a beautifully engraved silver case. Victorian watches were highly prized and were handed down from father to son. (*covgm_sh1965_214.jpg*)

Created by cvhjo220 Last saved by cvhjo220
Created on 11/06/2008 15:17:00 Last saved on 16/06/2008 14:00:00
G:\Arts_and_Heritage\HerbertRedevelopment\Phase 2 -3\New Galleries\FitOut\AV software\History gallery\Victorian\Coventry Time\Coventry Time build a watch text final 20080611.doc

Appendix D: 'Coventry Time' Interactive Design Brief, Herbert, a more detailed prototype description.

Reference Number: MWOE: 0501a

Multimedia Title: Designed for Life	
Sub Area:	Weird & Wonderful/Designed for Life
Visual References:	See adaptation interactive at "The Deep", Hull or Eureka, Halifax
Target Audience:	8+
Approximate Dimensions in mm *(LxWxH)*:	See gallery plan (screen size and slave)
Number of people using Interactive at once:	1 at console but several to view screen (slave).
Content Outline:	**Overall look and feel of game** Animals and environment will be 3 Dimensional computer generated animation, slightly stylised in design. They will behave with a certain amount of artificial intelligence. The virtual environment will be visible from a slave monitor, so it should be almost as much fun to watch as it is to participate. This interactive should be as open ended as possible, not relying on "correct answers" to operate. There should be as many permutation and variables as possible to prevent rapid resolution of the most "fit" combination of characters. Random environmental factors could prevent species dominance. **Biological Definition of Fitness** In this brief, "Fitness" is used in the biological sense (coined in the phrase, "Survival of the Fittest"). In this way, an animal that is "Fit" is essentially the one that has the most offspring. Therefore an animal with adaptations that enable it to compete more effectively with the other animals in the environment is more likely to live a healthier and longer life thus producing more offspring. This animal is considered more "Fit." **Initial Suggestions** User selects whether their animal is to be a herbivore, a carnivore or an omnivore. On selecting this, a random frame, which includes the mouth and feet type (e.g. sharp teeth and claws if carnivore) is generated that will ultimately dictate the overall shape of the end animal. The user adds cosmetic elements such as size, number of legs and skin colour that define what the creature looks like. Other parameters are then added to generate an overall "Fitness Quotient" for that creature (NB. the fitness quotient is calculated for the benefit

Appendix D: 'Designed for Life' Interactive Design Brief, WPM, page 1.

A) Carnivores = Scavenging, opportunist, specialist, ambush, sprinting, chasing
B) Herbivores = Constant grazing, rumination, hoarding
C) Omnivores = All of the above

The generated animal is then inserted into a computer-generated environment.

The ecosystem will only support 2 user-defined carnivores at any one time. When a third user-defined carnivore is introduced, it will be attacked by one of the other carnivores and either kill it or be killed itself, depending on it's fitness quotient. This strategy should prevent visitors from only ever producing carnivores, which would prevent the ecosystem from working properly. Carnivores will not breed, but will hunt herbivores and omnivores constantly and it's effectiveness will dictate how many herbivores and omnivores are present in the environment. The success of a carnivore can be calculated by dividing the number of successful kills by the number of attempted kills. There may be a requirement for computer generated carnivores to actively cull herbivores and omnivores.

Herbivores and omnivores will be able to breed. The numbers of any one animal on the plain is a direct result of how it's fitness quotient relates to the other herbivores and omnivores in the environment. Therefore the success of any one animal can be calculated as a percentage of number of one species of animal divided by total number of herbivores and omnivores in the environment.

The climate of the environment fluctuates on a daily basis between tropics and arctic, arid and swamp. Certain elements of the animal's design (such as warm/cold blood, opportunist/specialist, insulation and size) dictate how well much the animal's Fitness quotient is effected by the change. Therefore, at the start of the day, a user could create an animal capable of living in a tropical swamp that thrives, but then gets wiped out by the end of the day because the environment has changed to arctic tundra. This not only prevents any one set of animal parameters generating a dominant species, but also means that each time the user visits, the game will be different.

Appendix D: 'Designed for Life' Interactive Design Brief, WPM, page 2.

	The game could also ultimately be sold in the museum shop. **Timescale and Dwell Time Issues** Designing the creature needs to be a fairly rapid process to maintain a frequent throughput of visitors. Once their creature is designed, the user needs to get an immediate readout from the display as to how successful the creature is, in order to facilitate the user moving on once finished. To enforce this, the user could also be encouraged to watch how the creature performs on the slave monitor. However, it must be clear what factors are limiting or enhancing the success of the creature over time, so the message (ie. that creatures are adapted to fit into their environment) gets across.
Learning Objectives:	• Creatures are adapted to fit the environment they live in • Changes in the environment can cause extinction •
Emotional Objectives:	• Sense of achievement if designed animal is successful in its environment. • Wow factor!
Behavioural Objectives:	• Move on once creature is designed • Watch virtual environment on slave screen • Use skills acquired to create successful animal • Communicate within group.
Technical Information/Description:	Touch screen to select options. Slave screen showing virtual environment set at high level. Monitoring of success of creatures on SGMT web site
Type of Multimedia (e.g. game/database)	Game
Video/sound requirements & provider	Sound and CGI animation
Details *(inc. cost)* **of consumables/replacements**:	None

Appendix D: 'Designed for Life' Interactive Design Brief, WPM, page 3.

Earth – there is no AV in this section of the gallery

Water

2. Seascape AV Herbert to produce

Location:
Water Section 3B
Wall-mounted fixed screen

Audience:
All

Content:
This looped sequence shows a seascape in Dorset, England. It shows the action of waves on the shore and the dramatic natural arch of Durdle Dor in the background. It also shows the length of the beach with crashing waves in the foreground. Audio footage of waves upon the shore and seagulls was later added to the sequence. The purpose of the footage is to provide an ambience 'wallpaper' that evokes both the dramatic excitement of this sea view and also a sense of relaxation associated with seaside visits. The AV is positioned immediately above the 'land art' table and acts as inspiration for the visitor and as an obvious contextual link to the seashore debris which is available to the visitor to create land art with. To avoid sound pollution into other areas of the gallery, the sound from the AV is channelled to the table and its immediate surrounds by the use of a sound cone installed directly above the table. The sequence needs to have a manual on/off switch facility to be accessed by staff.

Duration:
5mins 4 secs (looped)
Aspect 16:9

Requirements:
AV has been sourced and edited by the Herbert
Hardware to be sourced and installed by AV hardware contractor

Specified AV Equipment

Item QTY	Product
1	40" LCD Display
1	Display Mount
1	Channel of MPEG2 Replay
1	Sound Cone
1	Channel of Amplification

Exhibit cost £

Appendix D: Elements Gallery Gallery Design Brief, Herbert, page 2.

Content
This consists of clips from 3 feature films about the Godiva story. The films date from 1911, 1928 and 1955 (the latter is in colour). The clips have been edited to form a short continuous film which lasts for 5 minutes. The film is operated by push button – once activated it plays to the end and then stops until the button is pressed again.

Requirements
HAGM to supply edited film
Aspect ratio 4:3

Paintings interactive touchscreen

Location
In Painted Godiva mounted on barrier in front of paintings

Audience
Mainly children, or children and adults working together

Content
This touchscreen allows the visitor to find out more about the details of the 4 paintings on display. The user can select the painting they are interested in from a menu/thumbnails. This appears on screen and the user can then touch on details in the painting. When they do this they will get a blow-up of the detail and a pop-up which gives them more details or asks them a question.
Another menu allows the user to find out more about the paintings and the artists. This would probably be short paragraphs of text.
Another menu allows users to look at images of other paintings in the collections which are not on display.

Requirements
Contractor to develop programme

A World of Stories Herbert to produce

Location
World of stories section on right hand side of the cupboard faced with a graphic panel (ST3G).

Audience
Children aged 5-8.

Content
This section will set the Godiva legend in the context of storytelling from around the world and will introduce a number of stories from different cultures. Each of these stories is about a hero who is set a challenge.
The interactive will be a 'Jackanory' style presentation. Visitors can choose from 8 different stories, told by two story tellers. Selection will be by push button and each story will last about 5 minutes.

Requirements
Aspect ratio 4x3.
Local induction loop needed

Created by cvmro030 Last saved by cvmro030
Created on 12/04/2007 11:56:00 Last saved on 12/04/2007 12:25:00
G:\Arts_and_Heritage\HerbertRedevelopment\Phase 2 -3\New Galleries\FitOut\AV software\Discover Godiva AV\20070412GodivaAVbriefsFinal.doc

Appendix D: Discover Godiva Gallery Design Brief, Herbert, page 2.

National Space Science Centre
Interactive and Exhibit Briefing Sheet

Briefing Sheet Number: 4001-2 ***Do not overwrite***	**Latest Revision Date:** [redacted] **Author:** [redacted]

NSSC Matrix Reference:NSSC/CL/M/PE
Working Title: TV Weather Studio
Suggested Exhibit Title:

Area

Entrance/ Exit		Looking Up	
Planetarium Holding Area		Space Now	
HUB		TEA	
Into Space		Resource Centre	
Exploring the Universe		Toilets	
Looking Up		Space Connections Trail	
Planet Earth	✓	Cafe	

Category of Exhibit

Demo / show (staffed)		Visual effect (Media sheet(s) appended)	
Hands-on interactive (physical / mechanical)		Graphics only (Image sheet(s) appended)	✓ **4001-2-Im-1** **4001-2-Im-2** **4001-2-Im-3** **4001-2-Im-4** **4001-2-Im-5**
Hands-on interactive with IT or MM (Media sheet(s) appended?)	✓	Graphic Text/ Text only (Image sheet(s) appended)	
Workshop activity (staffed/ unstaffed)		Audio only (Media sheet appended)	
Multi-media info station (Media sheet(s) appended?)		Model (Model sheet appended)	
Audio / visual (Media sheet(s) appended)	✓ **4001-2-Me**	Artefact (Object sheet(s) appended)	
Animation (Media sheet(s) appended)		Other *Please describe below*	

Other:

Target Market:	Nursery	5-8 yrs ✓	**8-14 yrs ✓**	14+ yrs	**Family ✓**	Adult	No. of Users:	**1-3**	Dwell Time: **4-6 (av)**

Desired 'Take Home Message' for this Exhibit:	This is how weather forecasts are made
Supporting messages	The climate may be changing (part of the future weather forecast).
Brief Description of the Exhibit:	Virtual weather studio, where visitor can give their own weather forecast, and can do weather in the future. They will have a choice of weather reports to do at least one current on and one from (say) 100 years in the future after severe global warming has occurred. If the IT will allow the visitor will be able to record their show and get a copy from the shop or desks. There will be simple GT panels explaining the terms used by weather forecasters and the various weather regions (Rockall etc.) outside the studio as points of interest.
What will the visitor do?	Give the weather forecast. Learn about the weather and climate change.
What emotions will the visitor feel?	Wow – I am a weather person on TV! Take that Ulrika! It's not as easy as it looks.
Where are the Turtles?	
Special Needs Considerations:	

National Space Science Centre
Interactive and Exhibit Briefing Sheet

CONTINUATION SHEET

Briefing Sheet Number: Do not overwrite	**Latest Revision Date:** **Author:**

Scientific Messages:	How forecasts get from measurement to broadcasts.	
Cultural/ Historical Messages:	The British obsession with the weather!	
Why are these messages important?		
National Curriculum Links:		
Connection to local / other science :		
The Exhibit's Physical Context:	**What other exhibits are part of this display?**	4001-3 Met Office interactive 4001-4/5 Play God/Flood you granny combined interactive.
	Why?	You can present today's and the future's weather.
Information (Bullet Points) for Copywriting:	The table defining each term used by the weather forecasters is interesting – in the Met Office bumf. It is about an A4's worth of 10 point writing that would be blown up to be readable. In addition, a map of the regions read out on weather forecasts (where is Rockall?) is available (see 4001-3). These are not essential and can be used as backdrops etc. if needed. See 'Flood Your Granny 4001-4' for future weather forecast information.	
Possible Sponsorship Opportunities: (See attached Sources Logging Sheet)	Powergen are interested in sponsoring this area. Currently being followed up by [redacted].	
Possible Technical Issues:	Buying video copies of the forecasts – logistics involved. Need [redacted] [redacted] input.	
Contacts and Resources:	[redacted] at the Met office might be able to help here.	

Appendix D: 'TV Weather Studio' Interactive Design Brief, NSC/HSD, page 1-2.

4001-2-SB Weather Studio Storyboard

Last Edited Tuesday, 30 November 1999 by [redacted]

General Layout

As the visitor enters it will need to be obvious where they need to stand to present the show – possibly by a differing floor finish. There will need to be some sort of resetting mechanism that restarts the show if a visitor walks out half-way through or if they want to restart the process – possibly a 'big red button'. There will need to be GT instructions as well as the AV instruction so that visitors know what to do/ how to reset etc.

The visitor will stand in front of a blank 'blue screen' and face a teleprompter, camera, and TV screen (possibly with a keyboard). The teleprompter will run through the script – this may need to be divided into parts that change with the push of a hand-held button as in the real shows. The camera will record the images that will be superimposed over the background – the camera could have limited movement to enable another person to get involved. The TV will show what is being 'broadcast' – i.e. where the visitor is standing in relation to the changing maps etc. Ideally, visitors outside the studio will be able to see what is going on either on other external monitors or on the internal monitor.

The Start

The instructions should be displayed and lead the visitor through what steps they need to take to start the show. The visitor will be able make two basic decisions: to do either a current weather forecast or a future forecast (set say 100 years in the future). If the technology is available, the visitor will be able to choose whether or not to record the show. If they could type in their name for identification purposes that would be a benefit. It should then be clear that they are expected to go and stand in the right place and what they need to do.

Current Forecast

If the visitor decides to do a current forecast, the basic script will run as follows:

- The Powergen Intro (if they sponsor the studio)
- The teleprompter will then lead the visitor through a script that presents the current weather. There will be scene changes of the 'blue screen' that should consist of at least:
    - An introduction screen (pretty picture with the name of the presenter),
    - A series of satellite images of the UK (the Space bit),
    - The pressure charts,
    - The forecast and then the summary.
- The Powergen Ending

Ideally, this could be automatically updated from the met office interactive but this could prove too complicated to do. We need to look at how this can be updated regularly (summer, winter etc. – maybe we just have a number of pre-done shows depending on the season)

The Future Forecast

This will be set 100 years in the future and done slightly tongue in cheek - hopefully using humour to get the message across. The basic script to run as follows:

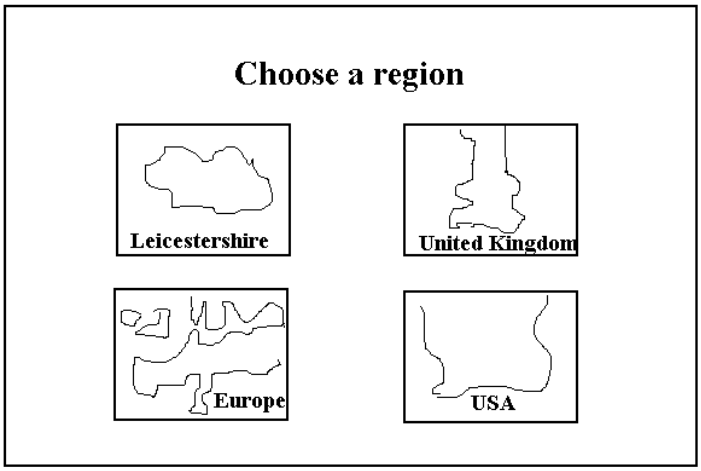
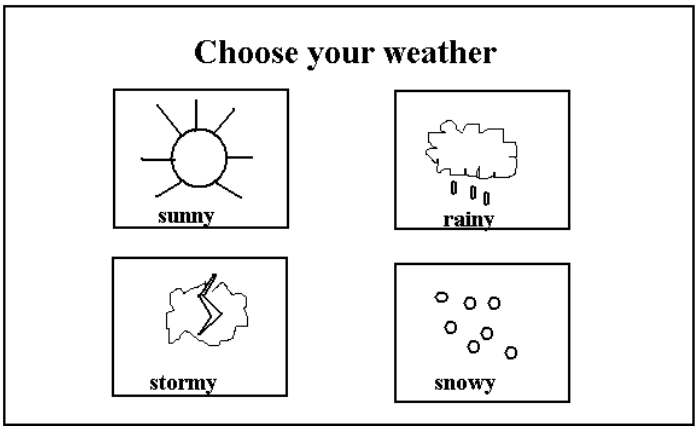
- The Powergen Intro (modified to look futuresque?)
- Then a similar script to the current forecast but with:
    - The map changed subtly to show areas that have flooded,
    - Temperatures that are higher than average ("The average temperature for June was the highest ever recorded – again"),
    - A fun bit (outbreak of tsetse fly in Devon, the weather for the seaside town of Salisbury, Winchester etc. – Need to check sea levels)
- The ending (again futuresque if possible)

The End

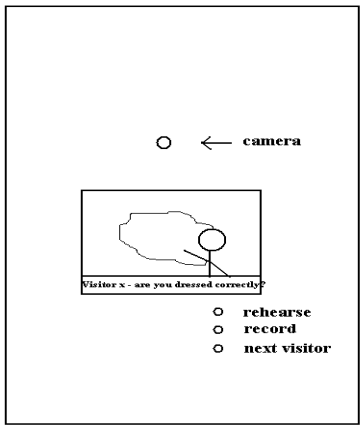
The visitor will be able to replay their show and decide whether to keep it, bin it, or redo it.
Does this need to be able to be switched off during busy times?

The show should then reset ready for the next visitor.

Appendix D: 'TV Weather Studio' Storyboard (paper prototype), NSC/HSD, page 1.

DESCRIPTION:	New computer and video game. Visitor 'creates' a weather forecast on the computer outside the studio. Then enters the studio to 'film' their report. Step 1 - Visitor selects a region and a type of weather from the touchscreen. Screen 1 and 2:   Screen 3: Thank you for selecting your weather forecast. Your number is x – remember it! Please enter the studio when your number is shown on the large screen above Step 2 – Visitor enters studio when their number is shown. A sign on the door reminds 'Have you selected your forecast from the touchscreen? Step 3 – Inside the studio, the visitor can put on some clothes that reflects their chosen weather (e.g. souwester and mac, sunhat and shades, woolly hat etc..) Step 4 – The visitor stands with their back to the blue wall, and faces a screen on the opposite wall, with a text bar at the bottom (?top?) that reads: 'Visitor x

– are you dressed correctly?'



Step 5 – The visitor presses the 'rehearse' button to practise following the autocue, which will scroll like karaoke lyrics in the text bar.

Step 6 – When they have had a rehearsal, the visitor will press the 'record' button to make a recording of their forecast.

Step 7 – The text bar below the picture will read 'Thank you visitor x, please replace any clothing you borrowed and exit the studio. Your recording will be available from the shop.' The slave monitor outside will show the next visitor number.

Step 8 – After 30 seconds (?), or when the 'next visitor' button is pressed, the text bar will change to read 'Visitor y – are you dressed correctly?'

Notes:

The slave monitor outside will show the activity inside the studio at all times, along with a text bar that shows which number visitor is inside the studio.

If the 'next visitor' button is pressed, the screen inside the studio and the slave monitor will both advance to the next visitor number.

Just in case someone misses their number or advances past it by accident, there needs to be a way to skip back to their numbered forecast.

Allow for:

- On screen text and instructions.
- Game to re-set if not activated within a 2 min period.
- Facility to download and save to VHS an individuals weather report for purchase on exiting the exhibition.

Note: The above is intended as design intent only. Concept and storyboard to be developed with Client and Haley Sharpe.

Appendix D: 'TV Weather Studio' paper prototype, NSC/HSD, pages 2-3.

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