Immersive Exhibitions:

Immersive experiences and visitor engagement

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Abstract

As part of the competitive tourism industry, museums and heritage sites are becoming more and more experiential in their exhibition design. There is increasing pressure to deliver satisfaction to wider audiences with aims of increasing social inclusion through learning. Learning is increasingly acknowledged as a discursive process, where meaning is generated through experience. This has led to the design of some exhibitions as immersive experiences which aim to engage the visitor through narrative and interaction. This dissertation examines the effectiveness of immersive approaches in engaging, and primarily affecting, visitors thereby increasing the likelihood of learning.

This research is set in the context of constructivist museum practice, and of immersive approaches at three case studies. The adoption of exhibition design practice based on previous research and theory is discussed as well as the ability of each site to generate visitor attention, engagement and emotional response. It is found that an immersive approach to visitor engagement can be very effective, that there are situational factors which may influence and affect visitor engagement, and that multi-sensory engagement can generate interaction and affect visitors.

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Contents

1. Introduction

1.1 Research questions and aims

This research focuses on the area of immersive design in interpretation with the aim of assessing current examples and investigating whether an immersive approach is effective in delivering the aims of interpretation and creating a positive visitor experience. Rather than assessing learning through specific learning outcomes this research investigates the ability of an immersive approach to connect with, engage and affect visitors, which may thereby increase the likelihood of learning (Gammon 2003).

This dissertation aims to investigate whether current examples of immsersive approaches reflect theory and research on visitor experience and whether they are effective in engaging visitors. If yes, which elements are most effective and why?

There is a recognised shift in the way museums, historic and cultural heritage sites are operating, largely due to increasing emphasis on visitor experience and learning (Gurian 2005; Lorentz 2006; Reeve and Woollard 2006; Falk and Dierking 2011) as well as competition from other experience based attractions (Pine and Gilmore 1998; Mason 2005; Prentice 2005; Lorentz 2006). This has led to more inclusive and participatory approaches to interpretation, including exhibits which aim to immerse the visitor and create a more in-depth experience which relates to the visitor. For example, the interactive Main Street reconstruction at Riverside Museum in Glasgow, or the British Galleries at the Victoria & Albert Museum (V&A) in London.

1.2 The developing role of museums

It is now acknowledged that historic and cultural sites are part of the competitive tourism industry (Prentice 2005), while research and pressure from governments which defray costs in return for education, access and social inclusion (Durbin 2004) have stimulated a desire to provide value for money to taxpayers and promote social inclusion by engaging a broad audience. The activities of libraries, museums, galleries and archives have been identified as impacting positively on social inclusion (DCMS 1999; Cabinet Office 2001), and the economic benefits of the historic environment have been highlighted (English Heritage 2000; DCMS 2003).

While collections and research remain high priorities, public learning is increasingly first and foremost, or at least equal to these functions (Hooper-Greenhill 1999; Falk and Dierking 2011). Museums offer an educational element which may not be present in many other sites which are competing for visitors' leisure time. A greater understanding of both learning theory and visitor motivations allows heritage sites to integrate the need to entertain with the goal of education through more engaging and emotionally affecting interpretation.

Active experience can play a central role in the learning process (Kolb 1984: 20) and therefore learning in an interpretative setting may take a more constructivist approach (Hein 1995; Mason 2005; Hein 2011), which recognises the importance of visitors' prior knowledge and experience upon new information and experiences. This shift from transmission models of communication to discourse and inclusion, means that interpretation must now be more participatory, diverse and experiential than ever before.

> "Museums were once understood simply as containers of worthy objects. Although by tradition they had classical porches and lofty ceilings, museums didn't strike anyone as particularly active. A museum was considered significant because it contained significant things. The idea that museums generate meaning by their inclusions, categories, juxtapositions and sequences is relatively new" (Nelson 2003).

It has been noted even since the end of the nineteenth century that simply displaying objects in cases and stating bald facts does not engage visitors, encourage them to visit or learn (Miles *et al.* 1988). Interpretation contains information, but information in itself is not interpretation (Tilden 2007). Although interpretation is functionally educational, this does not denote that interpretation must be educational in a didactic sense. Instead, interpretation is principally concerned with forming connections, provoking the making of meanings and affecting emotions to inspire, relate and reveal. Interpretation should not be instruction but provocation (Beck and Cable 2002; Tilden 2007). Current learning theory indicates a greater role for the visitor in the learning process, which may be achieved through more immersive interpretation. Visitors desire experiences with social interaction and active participation with challenging, new or unusual experiences (Weaver 2007:26) and demand authenticity with meaningful rewards based on emotionally affective and intellectual experiences (Goulding 2000; Brochu 2003:111; Weaver 2007:29; Wells 2007; AudioConexus 2012) and their interest and intelligence should not be underestimated (Moscardo 2003). Moreover, Alsop (2005) argues that there is strong evidence that affect and cognition are intertwined, that emotions have considerable influence on learning.

Museums are increasingly understood as social spaces as well as educational centres, with social interaction being a key motivational factor for visitors (Packer and Ballantyne 2002; Burch and Gammon 2006; Falk *et al.* 2007). Research has demonstrated a wide range of definitions and interpretations of visitor motivations and it cannot be assumed that people visit in order to learn (Black 2005). Any learning which occurs is free choice (Falk, Dierking and Adams 2011) and pre-visit motivations influence visitor behaviour and learning, and include both personal and situational factors (Packer and Ballantyne 2002:185). Black (2005) underlines the importance of motivation and argues that while learning theory should be used in the specifics of exhibit design, motivation understanding should inform wider spatial communicative design.

2. Literature Review

2.1 Learning theory and interpretation

2.1.1 Museums and learning

Museums and heritage sites are places of informal, lifelong learning (Hooper-Greenhill 1999; Black 2005) and it is increasingly recognised that the model of transmission and absorption does not provide accessibility to a broad audience. This audience must be seen as consumers and users (Mason 2005: 200), who are "equal and active participants rather than passive recipients of information" (Black 2005: 185). Active experience can play a central role in the learning process (Kolb 1984: 20) and therefore learning in an interpretative setting may take a more constructivist approach (Hein 1995; Mason 2005; Hein 2011). Each visitor is unique, along with their capacity and disposition to learn. This requires the museum to relinquish some authoritativeness in favour of accommodating diverse and unpredictable audiences. Visitors are participants and learners but, they also help determine the character and content of a museum experience (Lankford 2002).

2.1.2 The application of constructivism in museums

Constructivism suggests visitors should be given the opportunity to connect with familiar concepts, that to make meaning we must connect objects to prior knowledge and that this process has a significant effect on understanding and learning (Roschelle 1995; Falk and Dierking 2000; Falk and Adelman 2003). Hein (1995, 2011) maintains the applicability of constructivism in museums, suggesting the use of non-sequential environments and providing for multiple learning modalities. This may mean providing multiple choices of route (Brochu 2003:111), multi-sensory components and opportunities for various learning styles using different techniques and media (Harvey *et al.* 1998; AMES 2011).

Constructivist exhibits allow visitors to make their own conclusions about the meanings of an exhibition (Hein 1995). For example, Hein proposes that inviting children from diverse countries to share exhibits they have made with each other will help them learn about each other's cultures.

To what extent a constructivist approach to learning is applicable in the museum is a subject for debate. Black (2005) argues that it represents an idealistic position which, if utilised alone, holds no advantage over transmission models of communication. Visitors must still bring a level of interest and motivation, an "appropriate" level of prior knowledge and the skills and initiative required to construct meaning Black (2005: 140-148). The visitor's freedom to construct their own meaning may inhibit the ability of the curator or teacher to present a particular narrative and the way the object or site is interpreted has a direct impact on the meaning made in the viewer or visitor's mind (Falk and Dierking 2000; Mason 2005).

Meaning is not inherent to an object but socially assigned as well as altered by its presentation through re-contextualisation (Stam 2005:57). Furthermore, the use of didactic aids to link objects has been shown to increase dwell times and establish a route through an exhibition space (Klein 1993).

> "In the absence of contextual cues from the outside world, the patterns and associations stored within each person's head would remain dormant or meaningless" (Falk and Dierking 2000: 33).

However, it is important to note that Black (2005:140-141) criticises the use of a constructivist approach in exclusivity.

Dewey (1910), Kolb (1984) and Mason (2005) all highlight that an understanding and acknowledgement of memory and prior knowledge is extremely important when constructing narrative as they help to form emotional engagement and connection (Falk and Dierking 2000; Beck and Cable 2002; Peponis *et al.* 2003; Mason 2005). Constructivist exhibits attempt to reach visitors of all learning styles and promote accessibility;

> "…in such a museum, it is not assumed that the subject matter has an intrinsic order independent of the visitor, or that there is a single way for the visitor best to learn the material. Purely constructivist museum exhibits have no fixed entry and exit points, allow the visitor to make his or her own connections with the material and encourage diverse ways to learn" (Hein 1995: 6).

The key, therefore, to successful integration of a constructivist approach may lie in finding balance between visitor input and participation, and the interpretative messages. For example, the designers of the British Galleries at the V&A in London considered the narrative from the point of view of their audience and used a strong foundation of learning theory to consider the needs of the visitor, maximise accessibility and used participation to create a greater sense of involvement (Durbin 2004) by integrating architectural and stylistic reconstructive elements into exhibition design.

2.1.3 Motivation

Maslow's hierarchy of needs stipulates that in order to meet higher needs of self-actualisation, creativity and inner purpose, more basic physiological needs must be met (Huitt 2007; Atherton 2011). For example, restaurants, toilet facilities etc. Although Maslow's model is not supported by empirical evidence and has been criticised for being individualistic and not accounting for altruism (Atherton 2011) if the visitor's concerns about basic needs are dissipated they will not become a strong motivator which distract from the experience. Herzberg's motivational hygiene theory (Miner 2005) argues that negative motivators must be decreased as well as positive ones increased while Shackley (1999) stresses the elimination of negative cues. Visitors are also motivated by much more than basic needs and Lightner (1999) argues that visitors' interests and the exhibits relevance to

them are a primary motivation. Further motivations have been defined by Falk *et al.* (2007) and Packer and Ballantyne (2002) who provide visitor segments based on personality and motivation type.

2.1.4 Free-choice learning

Free-choice of what and when to learn is intrinsic to the visitor experience and visitors interact with museums in a sociocultural context (Falk and Dierking 2000, 2002, 2011). They often come in groups to engage and interact with each other as well as the exhibits. Studies by Vygotsky helped develop his Zone of Proximal Development (Atherton 2011; McLeod 2012). He observed that children performed better in tests when working in collaboration with an adult. Similar results were described by Wood, Bruner and Ross (1976) as scaffolding. These studies demonstrate interaction between two individuals allowing the less competent person to become independently proficient through guided learning (Chaiklin 2003). Applied to a museum context, scaffolding requires and enables the visitor to construct their own meanings through social interaction as well as cues within the exhibit. Museums must therefore be designed as social spaces. The extent of unguided participation which occurs at such places may be entirely site specific, however, it may be possible to determine the type of participatory exhibits which attract and hold attention thereby increasing the likelihood of participation and learning (Gammon 2003).

2.2 Aesthetic experience and flow

Constructivist exhibits aim to help audiences to make connections, ask questions, and find personal relevance with exhibits (Lankford 2002) thereby involving the visitor through active engagement, participation and interaction. Conceptions of aesthetic and flow experiences are consistent with constructivist, meaning-making museums as they are active processes supported by prior knowledge and driven by individual motivations (Lankford 2002:150).

2.2.1 Aesthetic experience

Aesthetic experience is characterized by;

> "…a combination of interest and pleasure and curiosity…the moment is one of heightened attention to perception, which is what makes it both meaningful and memorable. These are the qualities that foster subsequent worthwhile reflection." (Walsh-Piper 1994:105)

Walsh-Piper uses the example of the display of a quilt;

> "…questions of whether the true experience of quilts is felt only in their proper context and of who benefits when quilts are hung in museums go to the heart of the matter…by displaying the quilt as an object to look at and think about (a defining function of works of art) the museum makes an aesthetic choice and presents an aesthetic possibility." (Walsh-Piper 1994:107)

This concept may be seen by the use of objects or phenomena for their ability to engage on an emotional level, disregarding direct explanation or interpretation. Such isolation and placement of objects for visual contemplation is an outstanding feature of museum aesthetics (Duncan 2005).

There are numerous examples of museum displays which utilise such aesthetic techniques to enhance the experience such as unlabelled natural history displays (Maki-Petaja 2012), the walls of objects at the National Museum of Scotland (figure 1), and the atmospheric design and bold architecture of the ethnographic galleries at the British Museum.

Figure 1. NMS wall of objects (e-architect 2012)

However, it is important that such visual displays are used carefully as part of a wider communication strategy, not just for their “wow factor”. As Rybczynski (2002:4) argues, “wow factor may excite the visitor and the journalist, but it is a shaky foundation on which to build lasting value…it should have more to say to us than ‘Look at me’."

2.2.2 Flow

Flow is a mental state in which a person performing an activity is fully immersed in a process and is similar to that of aesthetic experience. It was first described by Csikszentmihalyi as ‘flow’ because respondents to his research described their experiences using the metaphor of a water current carrying them along (Csikszentmihalyi 1975). Flow is characterised by the presence of some or all of the following: intense concentration, complex mental activity, goal directedness, presence of challenge (mental or physical), and the interplay of knowledge, memory, emotion, sensation and perception (Lankford 2002:147). An individual may find flow in almost any experience (Snyder and Lopez 2002:91). For example, in observing an artwork, feeling a sense of wonder at an impressive or emotive museum exhibit, or performing a physically and mentally demanding task such as rock climbing, surgery or conducting an orchestra. Mihaly Csikszentmihalyi's theory of optimal experience, i.e. ‘flow’ argues that the promotion of a sense of wonder and individual interpretation is as important as the delivery of factual information (Csikszentmihalyi and Robinson 1990; Hein

1998; Lankford 2002:147). Csikszentmihalyi argues that a primary reason for unsatisfactory visits to art museums is a lack of flow experiences.

2.2.3 The value of aesthetic experience and flow

Flow and aesthetic experiences are closely linked. Research by Smith (1992) into aesthetic experiences resulted in similar conclusions to Csikszentmihalyi, as a result of which he identified various criteria which must be met to achieve effective aesthetic experience (Smith 1992; Lankford 2002; Parsons 2002). Although Csikszentmihalyi's theory of flow and Smith's definition of aesthetic experience are comparable, sharing an emphasis on concentrated attention, active cognitive processes, and integration of thought, feeling and perception, a distinction can be made. Csikszentmihalyi (1975) argues that factors including: the visitors' predispositions; aptitudes; social context; exhibition design; and, presentation affect experience. The museum as a whole bears responsibility to provide context for an aesthetic experience, along with the visitors' determination to make the most of the visit. Smith (1992) argues that as long as the visitor possesses the requisite aptitudes, the responsibility lies largely with the quality of the art (or exhibit).

Despite this distinction both men draw similar conclusions. First, aesthetic experiences are intrinsically worthwhile and instrumentally beneficial, helping to develop cognitive, affective, perceptual, empathetic and sensory aptitudes. Second, aesthetic experience requires prior knowledge, critical aptitude, perceptual acuity and emotional sensitivity and insight. Third, conceptions of aesthetic experience are consistent with constructivism and meaning-making museums. Although Csikszentmihalyi's account is more constructivist, Smith's account, which also requires aptitudes and abilities, similarly points towards the need for appropriate prior knowledge to invoke meaningful experiences. (Lankford 2002).

Many museums are moving towards an exhibition approach which embraces the aesthetic qualities and potential of their exhibits with the aim of engrossing and deeply involving their audience (Bitgood 1990). In doing so they are attempting to create a more immersive experience which is intrinsically rewarding. Visch *et al.* (2010) found that film viewers who were more physically immersed in their environment, for example, through a virtual reality experience, had more intense emotional responses. This further suggests that visitors' emotional responses to layout and environmental conditions may indicate the effectiveness of exhibitions which aim to deeply involve or immerse the visitor.

The conclusions drawn by Csikszentmihalyi and Smith provide insight into the potential benefits of aesthetic and flow experience opportunities as part of an active, meaning-making learning process. This might be investigated by inquiring about visitors' reactions and emotional responses to the aesthetic elements of exhibitions. Lorentz (2006) provides a theoretical framework which may be used to assess the aesthetics of an exhibition space.

2.2.4 The realms of experience

Csikszentmihalyi and Robinson's (1990) research into intrinsic motivation and optimal experience underlines the fact that as these activities are goal orientated and contain challenge elements (Lankford 2002) some individuals find certain experiences more intrinsically rewarding than others.

The impact of any component on the visitor is highly subjective; however, Pine and Gilmore's (1998) experience realms (figure 2) may be used to define the quality of an experience objectively. The richest experiences contain elements of all four realms at the point Pine and Gilmore call the "sweet spot" (Pine and Gilmore's 1998:102).

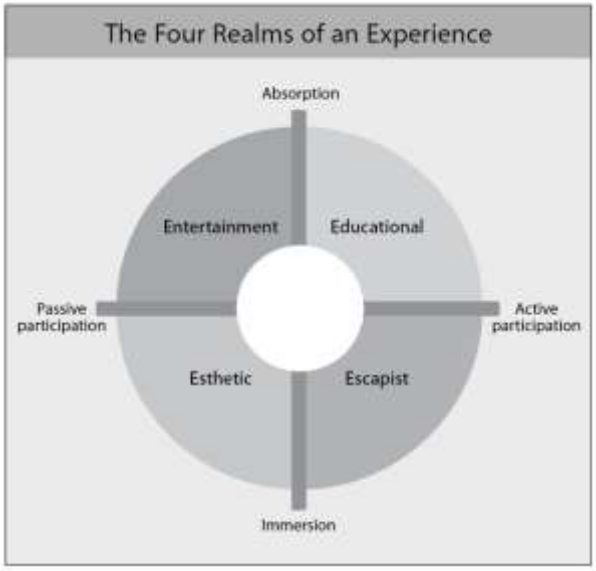

Figure 2: The Experience Realms (Pine and Gilmore 1998: 102)

The esthetics (aesthetics) of an experience refers to the overall environmental conditions and atmosphere, as well as the conditions which will create a sense of wonder or create a more in-depth experience, where participants are immersed in an activity or an environment (Pine and Gilmore 1998:102). This also includes elements which will make the place inviting, interesting and comfortable (Weaver 2007). The escapist realm of experience draws visitors in, immersing them in activities. This is the narrative layer, which may be referred to in interpretative planning as the connections phase (Brochu 2003:111), in which the message will be communicated and connections formed. The educational realm is active as learning requires the participation of the learner. This represents information and activities which will help to engage the learner in the exploration of knowledge and skills. Entertainment, like esthetics, is a largely passive aspect (figure 2). When visitors are entertained they are responding to the experience, e.g. laughing, enjoying, etc. This incorporates the elements of the experience that hook visitors in and hold their attention, encouraging them to stay. In practice this may be integral to the escapist realm in order to assist the narrative elements. For example, at Dynamic Earth, Edinburgh, descriptions of

tectonic plate movement are accompanied by a moving floor and dramatic visual and audio effects.

2.3 Engaging the senses

A key component of a participatory and experiential approach is sensory engagement. Experiences which aim to immerse visitors are, by definition, multi-sensory; engaging several physical senses. These experiences aim to involve visitors on multiple levels and draw them into the experience in depth, making the experience fun, engaging and unexpected (Weaver 2007:102).

Crowest (1999:8) argues that recognition of the potential for engaging multiple senses is highly self-evident within museums and that there is much provision to meet it, though hearing and smell stimuli are perhaps less well represented than sight and touch opportunities. Atkinson and Shiffrin (1968) present a model for memory whereby information is received by the senses and processed through short-term and long-term memory. At each stage this information is filtered, selected and even altered. Although this model does not account for differences in the abilities of the individual, experimental research has shown that multi-sensory engagement may improve short-term recall, and that recall of pictures is better than that of words (Baddeley 1976; Spencer 1991).

The implication for exhibition design is that multi-sensory exhibits may be effective for learning only if the sensory elements are mutually supportive. Crowest (1999:17-18) states "it is highly debatable whether the sound and smell of a steam engine provide redundancy with its visual aspects – they are providing complementary information, not the same information through different channels. Nonetheless, they may serve to make the whole experience more memorable." The validity of this statement rests entirely upon the context of the exhibit in question and the aims and objectives of the designers. Research by Baddeley (1976) concentrated only on the recall of factual information and not on emotional response, which is a core purpose of interpretation. However, Crigler *et al.* (1994) found that while audio alone can be just as effective as audio-visual stimuli at conveying information, a combination of the two arouses a more emotional response, supporting Crowest's statement.

Weaver (2007:104-105) argues the importance of engaging multiple senses from the pragmatic point of view of selling your place or product, and that allowing people to see, hear, smell and touch will positively affect the experience. Beyond this analysis, Lorentz (2006:93) argues that multi-sensory interaction, especially in new media, has a "profound effect" on exhibition communication, and that interactivity combined with information transfer forms the basis for immersive experiences in a learning or museum context. Harvey *et al.* (1998) found that interactive components, dynamic exhibits and multisensory stimulation influenced the visitor experience positively and helped stimulate flow experiences and immersion. While it was found that multi-sensory experiences, such as

watching a film, were not as influential as fully interactive exhibits, such as performing an activity at a science museum, all of these components were nonetheless highly salient and important to visitors in the study. Multisensory experiences make exhibitions more effective in engaging all types of visitors and make the experience more accessible for people with disabilities (Harvey *et al.* 1998).

Museums often use sensory interaction to demonstrate principles, for example, the 'Eddie Says' exhibit at Edinburgh Zoo shows visitors how they can manipulate their joints like a chimpanzee while monkeys cannot (see figure 3).

Figure 3. Eddie Says

Effective stimulation of interaction, which in museums and heritage sites may be done through multimedia, interactive exhibits, multi-sensory stimuli and live interpretation, increases the likelihood of learning which may be indicated by the attraction and holding power of exhibits (Gammon 2003:8). The effectiveness of such interactive and multi-sensory components may therefore be established through observation of how they are used by visitors and what reactions are stimulated.

2.4 Immersion exhibits

2.4.1 Definitions of immersion

Immersive exhibits attempt to transpose the visitor to a particular time and place (Bitgood 1990:283). History exhibitions can create authentic environments from the past, like the Main Street at Riverside in Glasgow; natural history museums may create natural environments and dioramas to provide context for exhibits, such as the dinosaur exhibits at the Beijing Museum of Natural History (figure 5); and science centres, like Dynamic Earth in Edinburgh, often develop various simulation apparatus to capture experiences like flight, underwater travel and the movement of tectonic plates (figure 6). These examples represent what Bitgood (1990:283, 2011:150) defines as "simulated immersion" which may be distinguished from "illusion" as the visitor is at all times aware that they are not in the actual environment being simulated, though they can feel like they are experiencing a part of it (Bitgood 1990:284). This may be seen, for example, in the Evolution House at the Royal Botanic Gardens, Kew (figure 4).

Figure 4. Evolution House, Kew (Inetours 2013)

Bitgood (1990) further defines other types of immersion as interactive, media, aesthetic and dramatic. Interactive and media immersion may involve effective computer software and audio-visual presentations. Aesthetic immersion refers to deep involvement in art work, and dramatic immersion involves live interpretation, a play or dramatic presentation (Bitgood 1990:284). Immersive experiences are multi-sensory, interactive and employ both the transfer of knowledge and the use of spatial devices to immerse the audience or visitor (Lorentz 2006:2).

Mortensen (2010:325) builds upon and compresses these definitions, describing three distinct models of immersive exhibit defined by Belaen (2003): reconstitution; creation; and interpretation. Depending on each model, the visitor may have more or less of a role within the exhibit. Nevertheless immersive exhibits consistently indicate interaction and a role for the visitor.

Figure 5. Dinosaur diorama, Beijing Museum of Natural History (China Highlights 2013)

Figure 6. Undersea Tunnel at Our Dynamic Earth, Edinburgh (Gastin 2009)

The reconstitution model expands on the analogous properties of the diorama and reproduces an existing reference world in an authentic way. For example, life-sized natural environments containing authentic specimens; such as the Dinosaur diorama at the Beijing Museum of Natural History (figure 5). The creation model is metaphorical, not based on reality but created for and within the exhibit. This aims to provide the visitor with a multi-sensory experience which does not necessarily correspond to an existing time or place. For example, a science exhibit allowing the visitor to explore their senses. Interpretation based immersive exhibits refer to a world which exists or has existed but do not aim to reproduce it in an authentic way in order to exhibit knowledge or experience which is not

representable on a realistic scale or to communicate abstract ideas or experience. Mortensen (2010:325) uses the example of a walk-through scale model of a human body. This type of exhibit follows the logic of the reference world which is interpreted to create an analogical representation, combining the logic of the reference world with the self-generated logic of the exhibit.

The immersive models of creation and interpretation diverge from basic analogy as they need not necessarily resemble the reference world but rely on an indicative or symbolic relationship with a time or place. Examples of the creation model can be identified in places like "Budongo Trail", the chimpanzee house at Edinburgh Zoo, which features forest reconstruction combined with interpretative panels and interactive exhibits as well as tree-top height views of the chimpanzee habitat areas (figure 7).

Figure 7. Treetop View, Budongo Trail, Edinburgh (Zoo News Digest 2010)

In addition to Balaen's models, Lorentz (2006:143) proposes key elements which are present in immersive experiences in a museum context: a threshold experience to create sensory isolation; narrative-centred experience; intellectual challenge; and multi-sensory experience. Interaction is a significant defining characteristic of immersion exhibits, with a sequence of interactions generating narrative (Macfayden 2009:21). The degree of interaction or 'agency' has a direct influence on immersion (Murray 2005:4). "When fully immersed, the real world fades away, and the user becomes detached to the extent that the interactive experience is all that matters." (Macfayden 2009:11).

Immersive experiences share five key characteristics which draw parallels with the concepts reviewed above, of which at least three are usually present within immersive settings (Lorentz 2006:45). These five characteristics are: selectively chosen participants; threshold – a transition into the experience; narrative; sensory experience; and limited experience length, i.e. a return to reality. These characteristics provide a framework by which immersive experiences may be defined, described and evaluated.

2.4.2 Narrative

Constructivism is about generating narrative through engagement and the construction of meaning and visitors will constantly form and change the narrative through context. Narrative in constructivist museums is closely linked to the ideas of guided learning, scaffolding (Wood, Bruner and Ross 1976) and Vygotsky's Zone of Proximal Development (Atherton 2011). Scaffolding provides assistance which is most effective when matched to the needs of the learner (McLeod 2012). Maintaining interest, simple tasks, directing the learner, emphasising certain aspects and demonstrating the task all aid effective scaffolding (Wood, Bruner and Ross 1976:98).

In museums, scaffolding is provided by the narrative which may be communicated in many ways. The use of technology assisted, visitor contributed narratives are increasingly used by museums to engage visitors and entice them to explore collections through storytelling (Fisher *et al.* 2008). Harvey *et al.* (1998) supports the view that staging and rhythm of the experience are significant, and that applying structural measures such as orientation (for example, through the use of maps), location of objects, media and graphic communication devices can help direct this. Unlike, for example, a film where the narrative is fixed, exhibition narrative is emergent through a user's interactions with the environment. Immersive exhibits should therefore incorporate drama (Macfayden 2009), and act as an imaginative space which stimulates a desire to explore and discover (Mortensen 2011:540).

Some authors suggest that narrative requires the presence of characters, interaction with whom is a goal of interactive narrative (Murray 2005). Characters can act in a number of roles; guides, models or interactive agents. They attract and stimulate audiences, offering a more memorable experience than the same content presented without them (Leon and Fisher 2006). In a museum these characters can be virtual, hypothetical, or even the objects themselves. For example, virtual guides were used at the Museum of Science in Boston to engage children (Swartout *et al.* 2010).

The development of narrative is important for emotional engagement, which may in turn influence information processing (Astleitner 2004). For example, sympathy (feelings about a character) may be provoked by text segments which use suspense, realism, dialogue, and occur towards the end of a narrative (Dijkstra *et al.* 1995). Narrative may also be conveyed in a manner by which an analytical approach to the design of spatial devices is applied. For example, small objects may be made significant and larger objects made to recede by varying the isolation and distance of objects from each other to convey a hierarchy of significance (Duncan 2005).

The use of narrative also has implications for learning and it has been suggested that we process visual information in a narrative way (Baddeley 1999, Wolfe and Mienko 2007). Although Wolfe and Mienko (2007) found that presenting information as a narrative to those with little prior knowledge may be more effective for learning. This implies that the

learning of a subject without substantial prior knowledge is made easier by the presence of narrative. The presence of narrative and characters does not in itself guarantee learning outcomes, however, characters should be used carefully and stories must present all the information which may require contextual illustration, story and demonstrable principles (Leon and Fisher 2006) in order to communicate the narrative effectively.

2.5 Conclusion

This literature review has identified that immersive environments may be an effective method of constructivist communication in museum exhibitions. Learning is a process throughout which learners undergo changes and interact with the material more than merely absorbing it (Hein 1998:30). The element of challenge provided by this learning experience also, according to Csikszentmihalyi, enhances satisfaction, providing further credence for the provision of interactive and intrinsically rewarding immersive elements which allow the visitor to test themselves.

Immersion is also dependent upon the willingness of the visitor to engage. For example, Smith *et al.* (1998) argue that people who are daydreaming remain relatively in touch with their surroundings. Their attention can be easily gained and therefore the ability to stimulate this arousal is a key consideration in exhibition design. When watching a film the sensory stimuli (i.e. light, sound, picture, physical space) are controlled and the viewer relies on sight and sound senses for engagement. In exhibitions the visitor is free to move around and engage with any elements they choose. Museums therefore, may create memorable experiences by combining the emotional and sensory with the physical and intellectual (Lorentz 2006:58).

This review proposes that immersive experiences are verifiable experiences which may be coherently designed in order to meet new visitor expectations. Immersive exhibitions may be defined primarily by the use of a variety of communication strategies and techniques to create the visitor experience. Bitgood (1990) and Lorentz (2006:142) provides Michael Heim's (1998) three 'I's to define an immersive experience concisely: immersion; interactivity; and, information intensity. This provides a clear limit to the number of variables having an impact on the experience. In addition, the five key components of immersive experiences (selectively chosen participants, threshold, narrative, sensory experience and limited experience length) may be examined. Lorentz (2006:144-146) uses these principles to briefly examine four case studies which met these criteria.

Constructivist exhibits rely on engagement and narrative to construct meaning and there is a relationship between textual and spatial narratives which provide guidance for the experience. The quantity and presentation of information is important to the success of an immersive exhibit which means that immersive exhibitions need not be simulations and external environments but internally stimulating and engaging to the visitor. The presence of narrative is therefore a key component. The presence of the properties which define

immersive experiences may be indicative of the effectiveness of an immersive exhibit. It is important to know and understand the actions and reactions of visitors in immersive environments and whether they reflect the aims of interpretation.

3. Methodology

3.1 Introduction

This study aims to investigate whether immersive exhibits are effective in visitor engagement and learning, and which elements are most effective, by observing visitor behaviour. This study will investigate site design, visitor behaviour and visitor attitudes towards their experiences in order to investigate whether current examples of an immersive approach are effective and why.

3.2 Study sites

Three study sites have been selected in order to consider a variety of immersive experiences. Each site offers a different approach to immersive interpretation: the entirety of a building; a single exhibition space within a museum; and, one room within an exhibition. Some background material has been provided by each site, which provides insight into site aims (see appendix 1).

3.2.1 Budongo Trail, Edinburgh Zoo, Edinburgh, Scotland

Budongo Trail, the chimpanzee house and habitat at Edinburgh Zoo (RZSS), is appropriate for this research as it had a clear goal of incorporating an immersive approach. The exhibition includes reconstruction components and a multi-sensory, interactive exhibits as well as chimpanzee viewing areas. The space is divided over two floors, with the story of the RZSS's work in Budongo forest in Africa at ground level, and chimpanzee viewing areas on the second floor which also features the interactive elements.

3.2.2 Main Street, Riverside Museum, Glasgow, Scotland

Main Street consists of a life-sized period street reconstruction featuring reconstructions of previously existing shops and buildings ranging from the 1890s to 1980s, including genuine fittings in some instances. This reconstruction allows visitors to enter many of the shops and to interact with the interior in various ways which include audio-visual presentations and interactive multimedia. Visitors are afforded considerable freedom in the ways they wish to engage with the space and how deeply they want to engage with the narratives.

3.2.3 Culloden battle experience, Culloden, Scotland

The Battle Experience is closed off from the main exhibition space, and shows projected film of a battle re-enactment. Images are projected onto all four walls, surrounding the visitor in the centre of the room. Action happening on one wall is mirrored on the opposite wall. For example, if a soldier fires a weapon on one screen, the opposite screen shows the result simultaneously. The scenes are realistic and the environment is designed to provide maximum sensory impact.

3.3 Sampling frame and population

The sampling frame consists of all visitors to each site area on the days of this research. Visitors will be randomly selected as they enter the study area, with the next observation beginning as soon as the researcher is finished the previous observation (Yalowitz 2004). Visitors under the age of 18 will be excluded in accordance with UHI ethic guidelines. This will be done by estimation (Yalowitz 2004), which does introduce an element of researcher bias, but is necessary in order to avoid interfering with visitor behaviour and potentially influencing the observation. This bias should not affect the study data as age groups will not be used as a variable in analysis.

3.4 Research design

This research will use a mixed methods approach in order to investigate whether each immersive approach is contributing successfully to interpretative aims and if the effects on visitors are concurrent with desired outcomes. A mixed methods approach can allow qualitative data, such as interviews, to lend additional validity to theory, experiential and observed findings (Chrysanthi *et al.* 2012). The quantitative research aims to observe what is happening and the qualitative aims to explore why (Gammon 2001:5).

This study has an evaluative function involving the assessment of specific case studies which will be measured against a framework of criteria along with the use of observational studies and semi-structured interviews, which allow the topic of conversation to be directed by the interviewer but, also allow questions to be asked in different ways with additional explanation (Gammon 2001:6; Bates *et al.* 2012) to ensure they are understood clearly by the respondent (Diamond *et al.* 2009:76; VisitScotland 2012:11). The rationale for this approach is to achieve triangulation, which seeks convergence and corroboration of results from different methods (Johnson and Onwuegbuzie 2004:22). Triangulation has been criticised as it may imply the existence of a single, definitive account of the social world and assumes data derived from different methods can be regarded as equivalent in terms of their capacity to address a research question (Bryman 2013:4). Nevertheless, it adds a sense of richness and complexity to an enquiry, enhances credibility (Bryman 2013:4) and may even indicate which interpretation of phenomena are more likely to be valid (Hammersley 2008:32).

> "The case of triangulation illustrates…how relatively straightforward practical research strategies can become caught up in the philosophical debates that now plague social inquiry. Checking other sources of information…is a routinely used practice...incorporated into scholarly work in history and human sciences long before the triangulation metaphor was developed. Given this, we should hesitate to reject it on philosophical grounds." (Hammersley 2008:30-31)

3.5 Theory based evaluation

Each site will be assessed against a comprehensive theoretical framework based primarily on Lorentz (2006) as well as learning theory and immersion, aesthetics and exhibition theory. This will take into account the immersive visitor experience as a whole, whether the research area is a single exhibit, as at Culloden, a part of a museum, as at Riverside Museum in Glasgow, or an entire building, as at Budongo Trail at Edinburgh Zoo. This framework will form the basis for an assessment which will consider the immersive experience in terms of cognitive psychology theory, design, learning theory and visitor experience. This theoretical framework is informed by the literature review section of this dissertation which explored the interacting and often complementary areas of constructivism, aesthetic experience and immersive design.

Lorentz (2006) provides an extensive contextual study and theoretical framework for the design of effective immersive experiences by tracing the rise of the experience economy, examining a broad range of cognitive and experiential design theory, and scrutiny of studies such as Bitgood (1990) and Harvey *et al.* (1998). This is subsequently applied to, and demonstrated through specific case studies. A key distinction, however, between this study and Lorentz (2006), is that Lorentz assesses the immersive values of exhibitions which do not necessarily seek to recreate a time or place whereas this study includes exhibitions which may be viewed as immersive through reconstruction or recreation of a time or place.

The primary criteria which will be used to first assess the sites are Lorentz's (2006:143) key elements of immersion which include: threshold experience; narrative centred experiences; intellectual challenge (to some extent); and, multi-sensory experiences. Consideration of these site attributes will include opportunities for flow and aesthetic experiences, learning opportunities, the use of technology and multi-sensory and interactive components. In order to apply this framework each site will be discussed in regards to Lorentz's above criteria which may show whether each site design should be effective in light of the criteria. This may corroborate or provide additional insight to findings from the observational study and interviews.

3.6 Observational study

This study will use observational techniques in order to establish circulation patterns and dwell times at specific elements and exhibits, providing data that will provide information on the relationship between visitors and the exhibition space.

Visitor observation and tracking are common, usually quantitative, research methods which allow researchers to discover circulation patterns (Klein 1993), measure times spent by visitors at specific elements or areas, and determine how visitors interact with the exhibits, their surroundings and each other (Bitgood 2002). In addition, observation may be used to record qualitative as well as quantitative data (Chrysanthi *et al.* 2012). Visitor observations

are an effective way of understanding visitor interactions with an exhibit without the disadvantages of exit survey whereby the visitor is required to remember what they did and for how long. These studies can give information on visitor numbers and how visitors are interacting with particular components of an exhibition. Observational methods do have some limitations. They provide only behavioural data; they do not provide definitive demographic information or any qualitative data on visitor motivations, feelings or thoughts. Dwell times can be observed but the reason for the visitor stopping cannot, they may find the exhibit fascinating or very confusing (Binks and Uzzell 1990).

According to Yalowitz and Bronnenkant (2009) there are four main variables which may be recorded during an observational study; stopping behaviours, other behaviours – what they did above and beyond stopping, observable demographic variables, and situational variables – anything which may affect behaviour such as crowding, date and time, special events or staff, etc. This study will aim to record variables within all of these categories.

Observational studies will be conducted at each case study site with the exception of Culloden. Conducting a study of this nature in a confined space will undoubtedly impact on both the visitor experience and the data collected as participants will almost certainly be aware of the researcher which may influence behaviour (Diamond *et al.* 2009:42). Observations would also be very speculative, as the primary interaction would be mental, rather than physical. There are no exhibits to observe or routes for visitors to take, although they may move freely around the room. In short, observations would provide very little useful information.

At Budongo Trail and Riverside, movement tracking and basic observation techniques will be used including route tracking on a floor plan.

Figure 8 shows the plan for Edinburgh Zoo Budongo Trail which was composited from plans provided by the Zoo. The area accessible to visitors is shaded green. After testing, the labels were removed to allow clearer recording of visitor movement.

Figure 9 shows the plan for Riverside Museum, with the observation area shaded in light grey. If visitors leave the observation area to use facilities such as the toilets or catering they will be deemed to have left the immersive experience as their attention has been turned towards the fulfilment of more basic needs.

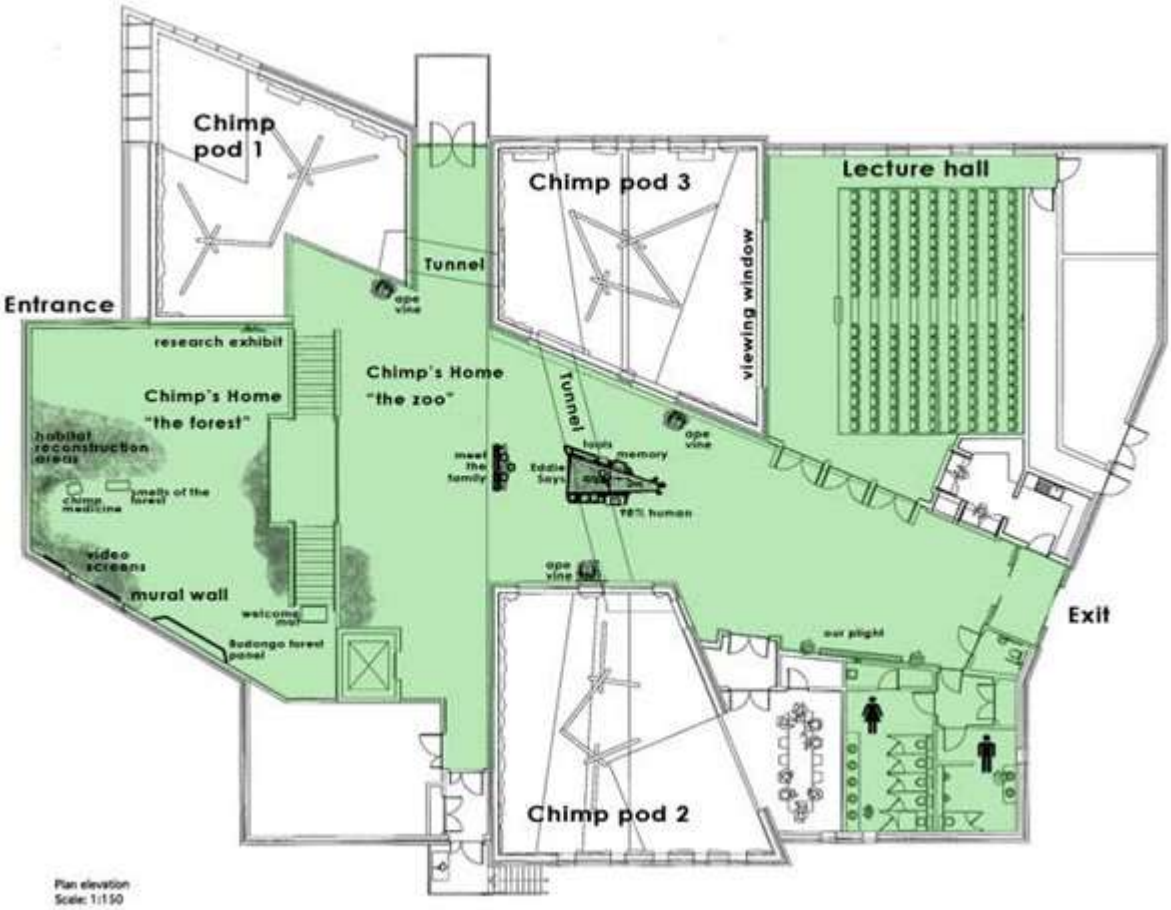

Figure 8: Budongo plan

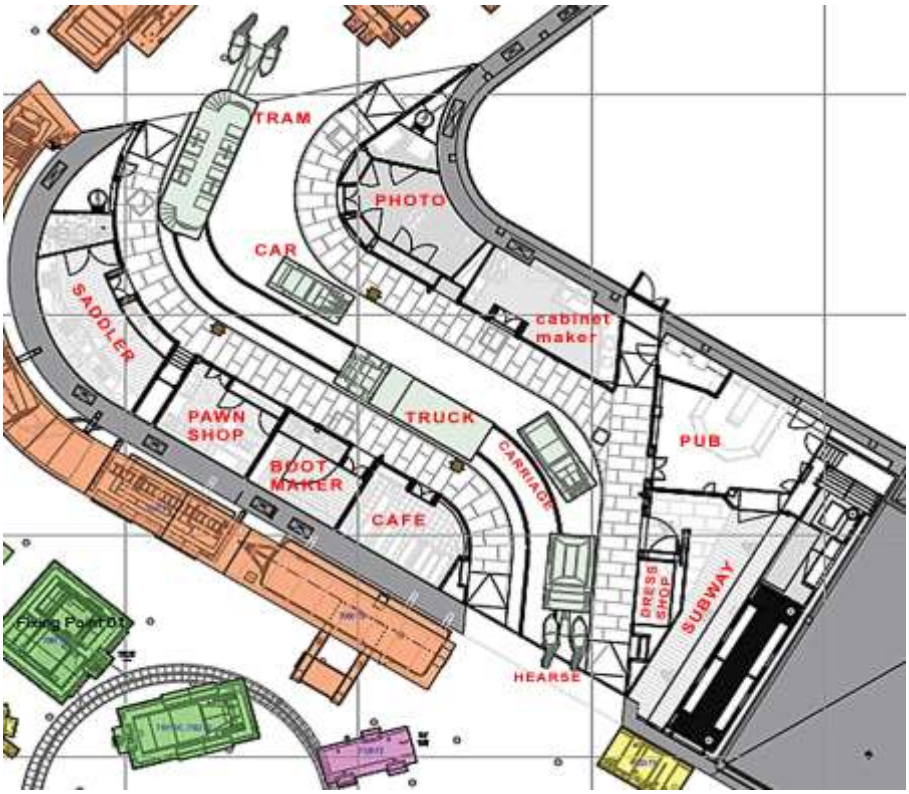

Figure 9: Main Street plan

3.6.1 Observation sample

Visitors will be selected for observation based on guidelines from Yalowitz and Bronnenkant (2009) and Diamond *et al.* (2009). Focused individual sampling will be used to record the behaviours of one individual for the duration of their activity within the study space in order to provide as complete a record of the visitor experience as possible. As it is common for people to visit in groups one visitor from each group will be selected for observation. Where visitors stop and dwell times will be observed and noted (Diamond *et al.* 2009:55-58). Visitors will be selected at random depending on visitation levels to the study area. This may range from every 3rd to every 10th visitor or the first visitor to enter the area once the researcher is ready to begin a new observation (Yalowitz and Bronnenkant 2009:51).

The component elements of the exhibitions will be defined in terms of how accurately the observer is able to identify what visitors are attending to. If this is not clear, for example in instances of several exhibits grouped on a wall or panel, then they may be grouped together as one element (Diamond *et al* 2009). At Budongo Trail each exhibition component is very clear and the researcher will be able to observe visitors from various angles. At Riverside, shops will be considered individual elements as there are so many items in each that it may not be possible to tell exactly what the participant is attending to. The defined components are included on the plans in figures 8 and 9.

Diamond *et al.* (2009: 58) recommends collecting 30-50 tracking observations in total consisting of various visitor demographics over several days for a representative sample. This will enable the observations to be sorted into patterns and categorised if necessary. This study aims to record at least this number of observations, however, there is a need to recognise the fact that visitor numbers through a particular exhibit are not predictable or reliable. It is hoped that large, indoor, year-round attractions like Edinburgh Zoo and Riverside Museum will provide sufficient visitor attendance for this aim to be feasible.

3.6.2 Recording and timing

Movement tracking will be used to record visitor routes. Movements will be recorded digitally using a touchscreen android tablet to overlay routes on a map of the exhibition area being used. This will provide a digital copy of all observed routes which can be backed up, minimising risk of data loss, as well as allowing the viewing of multiple routes at once during data analysis.

'Pencil-and-paper' timing and tracking will be used for all observations of interactions and behaviours rather than video or more sophisticated software techniques. Although Yalowitz and Bronnenkant (2009) provide a compelling argument for the use of video recording or handheld computer software these are not feasible within the scope of this research. Video recording raises ethical issues regarding anonymity, as well as practicality issues as some areas may require more than one camera. For this research permission to observe

unobtrusively was obtained prior to study and visitors were made aware of research using signs at the entrance points to each site.

Yalowitz and Bronnenkant (2009:53) argue that the specificity data may be an issue with pencil-and-paper tracking. For example, many studies do not include times at specific elements, but this does not prevent the tracking of visitors through the exhibits as well as noting what visitors attended to and for how long. Time at components can be measured with a stopwatch. The difficulty lies in recording phenomena which occur simultaneously. For the purposes of this research stopping and dwell times will be recorded, while multiple behaviours such as conversations and interactions will be noted and categorised but not necessarily timed. Situational factors such as crowding, and in the case of Budongo, what the chimpanzees are doing, will not be recorded due to the complicated nature of observing multiple variables.

Although previous guidelines have defined visitor "stop" as "stopping with both feet planted on the floor and head or eyes pointed in the direction of the element for 2-3 seconds or more" (Serrell 1998 in Yalowitz and Bronnenkant 2009: 50) this definition is problematic in this study as some components are large enough that the visitor need not physically stop to engage with it. This issue is particularly notable in aquariums, zoos and art museums where visitors may be moving around almost constantly to see the animals. Therefore, it is more appropriate in this instance to apply the term "attending to" to define a stop so planting of the feet is not required (Yalowitz and Tomulonis 2004). "Attending to" incorporates the time someone may be engaging with an exhibit which moving through a space (Yalowitz 2004:6). In this way all elements and components of an exhibit may be included in studies and the times visitors pay attention to an exhibit are less likely to be underestimated. The issue which remains is related to researcher training and testing, each data collector must record "attending to" in the same manner. This study will not be affected by this particular issue as there will only be one data collector.

3.6.3 Indicators

As a key attribute of immersive exhibits is the ability to attract and hold visitors' attention indicators are necessary in order to assess the level of engagement the visitor is experiencing with a particular exhibit or exhibit component. Diamond *et al.* (2009: 60) and Gammon (2003:8) both provide indicators for categorising visitor behaviour.

While Gammon's indicators (table 1) are designed to record types of learning, these same behaviours can also be used as indicators of an exhibits ability to attract and hold attention, i.e. engage.

Type of learning	**Weak Indicator**	**Medium Indicator**	**Strong Indicator**
Attract and hold attention	Pay attention to exhibit, activity etc – stop and look [for how long?] Point to or ask question about [how many?] Successfully complete activity at least once [difficulty of activity]	Focus attention for enough time to complete activity / read text Listen attentively Join in activity Handling exhibit / perform activity carefully and purposefully Call others over to see exhibit/join in activity Express interest in exhibit, activity Describe activity as enjoyable, entertaining Complete activity and stay afterwards to ask further questions Write brief notes, take a photo	Pay attention for more time than is required to complete activity, read text Stop, look at and discuss at length, as series of related questions about Repeat activity several times Leave and return to exhibit, activity, etc Say that they felt absorbed, fascinated, involving, inspired by the experience Taken extensive notes, draw, take several photos Children engage in extensive, exploratory, imaginative or role-play

Table 1. Attract and Hold indicators (Gammon 2003:8)

Gammon's indicators also provide more explicit categories and specific behaviours (such as taking photos) which may be less subjective than the indicators provided by Diamond *et al.* (see table 2). Subjectivity may be an issue, particularly in distinguishing between 'minimal/glance' and 'cursory' behaviour, and in identifying whether visitors are reading text or merely looking at the panel or pictures. While subjectivity may be present in assessment of the amount of time spent at an exhibit recording this allows the researcher

freedom to balance time spent and accompanying behaviours in order to assess and categorise behaviour.

1	MINIMAL/ GLANCE	Visitor stops, pauses briefly, glances at one or more elements but demonstrates no apparent interest in any particular element or information.
2	CURSORY	Visitor stops, watches, or touches elements briefly in a cursory way, perhaps casually points to something; glances at text panels, but demonstrates no apparent interaction with exhibit.
3	MODERATE	Visitor stops, interacts with elements of the exhibit with apparent interest, reads some text; appears somewhat engaged and focused.
4	EXTENSIVE	Visitor stops, interacts with elements of the exhibit intently; reads some text; appears engaged and focused.

Table 2. Engagement scale used to assess visitors' engagement (Diamond *et al.* 2009: 60)

The indicators set out by Gammon (2003:8) (see table 1) will be used to categorise visitor behaviour. Only the observable learning indicators will be used in this study.

In order to quantify these data, Gammon's learning indicators will be numbered (1, 2 and 3 for weak, medium and strong respectively); participant behaviours will be assessed and given an appropriate numerical designation for each interaction. Although an assessment of learning is not a primary concern of this study, these indicators will be used to categorise, quantify and assess visitor engagement with exhibits, reflecting Gammon's (2003) contention that level and type of engagement is key to learning. Table 3 shows how the observational data will be recorded, with behaviour notes and dwell time determining the indicator category.

Exhibit	**Behaviour notes**	**Indicator**	**Dwell time (seconds)**
98% Human	Looked, took photos, used touchscreen, showed accompanying child,	3	120

Table 3. Example of observation template

3.7 Interviews

Conducting semi-structured interviews in conjunction with observational studies allows further qualitative data on observed demographic or psychographic variables which may influence the observed behaviour (Yalowitz and Bronnenkant 2009). Observational data has more validity for assessing what visitors actually do, whereas qualitative data may be used to assess emotional responses and attitudes (Bitgood 2002). Interviews with visitors can provide useful exploration of research issues when investigating visitor perception (Chrysanthi *et al.* 2012) and can deliver rich, detailed, qualitative information (Gammon 2001; Diamond *et al.* 2009, Bates *et al.* 2012) which can be very revealing and true (Binks and Uzzell 1990). The questions and answers need not be derived from preconceived notions of what memories or aspects are important, but rather to facilitate recall without unduly biasing the responses (Falk and Dierking 2011: 116). This enables exploration of issues both guided, and in response to, the respondents' answers and motivations (Binks and Uzzell 1999).

Interviews can hold a number of significant advantages over self-completion surveys, which was another method considered for use in this study. In addition to the richness of data a smaller sample can be used to provide much more detailed and rich data. Self-completion surveys require a far larger sample in order to be representative. Even large samples are still unlikely to be representative as "you will end up surveying a few highly motivated individuals who are often incredibly pissed-off about something. Interviews are more costly and time-consuming but give you much more reliable data" (Gammon 2001:2).

3.7.1 Interview sample

Visitors will be approached on exiting the exhibition space and will not be selected from those who have been observed in order to avoid selection bias. At Culloden and Budongo trail there are clear exit points, whereas Main Street has two potential exits. Here, visitors will be approached at each point in turn. Interviews will be done on site over several days and interviews may be scheduled for a specific interview day if necessary. Ideally respondents will have just completed their visit to ensure the experience is fresh in their minds.

To minimise sample bias, a continual ask method will be used (Falk *et al.* 2007) by approaching the first available visitor exiting the study area. In order to minimise demand characteristics, i.e. the tendency of respondents to alter their responses based on the perceived agenda of the researcher, there will be no incentives given to respondents and no emphatic statements will be made regarding the potential benefits of the responses to the institution (Marino *et al.* (2010). This is contrary to the approach of Falk *et al.* (2007) and was highlighted as a risk to the validity of that study by Marino *et al.* (2010).

Sample sizes will reflect the level of emphasis put on the data. For example, because observational study will not be used at Culloden the interview sample will be larger, whereas interviews from Riverside and Budongo Trail will be used in conjunction with observational data, so the sample will be smaller. If it is apparent that the respondent is a non-native English speaker, they will be asked if they are comfortable completing the interview in English. If not, they will be eliminated from the sample but their participation refusal and reason will be noted.

3.7.2 Interview formulation and analysis

Semi-structured interview techniques will be used as informal conversational interviews may not allow questions to be directed towards a certain topic and can be difficult to analyse as different questions have been asked of each respondent (Diamond *et al.* 2009:72). This would not be possible with structured interviews, which are more appropriate for statistical analysis. It is important that the imposition of bias by the interviewer is avoided and the interviewee must be made comfortable in an environment where there is no implied judgement or criticism (Diamond *et al.* 2009:69). Interviews should be structured carefully, beginning with more simple and interesting questions in order to ease the respondent into a position where they feel comfortable answering more complicated or important questions (Arizona Office of Tourism 2007).

Interview questions and topics will not concentrate on the respondent's recall of facts or information. The viewpoint that these are the only key indicators of learning is not appropriate for museums and the definition of education within interpretative settings emphasises the process of learning rather than the outcomes, including affective and cognitive elements (Hooper-Greenhill 1994:74). Emotions and feelings responses which influence attitudes, values and perceptions underpin the acquisition of knowledge (Hooper-Greenhill 1999:68). Emotional engagement is therefore vital for learning, so it is appropriate to explore how visitors believe their emotions and attitudes have been affected by the experience in question. Questions about the nature of the visit and how respondents interacted with the environment may lead to follow-up questions regarding perception of the subject. This may shed light on the emotional connections made between the visitors and the subject matter.

Like Falk *et al.* (2007) this study will consist of respondents reporting what they believe or understand. While there is a considerable weakness in this self-report approach when investigating acquired knowledge, it can be used to effectively explore emotional response, perceived belief and attitudinal changes (Marino *et al.* 2010) which this study aims to explore. After interviews are transcribed analysis will be conducted using WEFT Qualitative Data Analysis program for Windows. This enables categorisation of text sections for visual analysis by the researcher. Full transcripts and interview templates are detailed in Appendix 2.

4. Theory based evaluation

The aim of this section is to provide a brief analysis of each site with regards to the elements which may affect the immersive qualities of the visitor experience argued for in the theoretical framework. The key components of an immersive experience which will be examined are;

- selectively chosen participants
- threshold
- narrative
- sensory experience
- experience length

4.1 Budongo Trail

Budongo Trail is housed in a purpose built structure within Edinburgh Zoo, containing both exhibition space and chimpanzee habitat areas with large viewing windows. The ground floor contains fewer interpretative components than upstairs, and concentrates on the work done in Budongo, Uganda, by the RZSS. The exhibition contains elements that illustrate simulated, interactive and media models of immersion (Bigood 1990) which may best be defined as Mortensen's (2010:325) interpretation model, as the exhibits do not attempt an authentic recreation of a time or place but rather serve illustratively to create an ambience. The space is designed to inspire a sense of awe and wonder using height and scale, and engages people using multi-sensory stimuli and interactive elements. Visitor experience length is only limited by the opening hours of the Zoo, although visit length figures are detailed in the observational study results.

The threshold experience is provided by the entry into the lower level where visitors are met with the habitat reconstruction area and an introductory sign to the exhibition on the right-hand side. The realistic vegetation, rocks, wooden structure, large wall display and mural all help to inspire a sense of awe (wow factor) and provide visual context (see figure 10).

Figure 10. Budongo entrance

Another key threshold lies between the two exhibition areas, transitioning between the two chimp 'homes'. This is the staircase which features several visual cues (see figure 11) designed to communicate that this is the 'chimp's home' as well as relate to visitors' prior knowledge and experience;

> "Let's think of it as being a house, so there's the forest, and you go from the forest into the house. When you visit someone's house what do you find? Quite often there's a mat on the doorstep, so on the floor we have a welcome mat which says 'welcome' (in Swahili and English) at the bottom of the stairs…as you go up the stairs there are photographs of chimps just like family photos on somebody's wall, and there's an outline of a chimp in terms of their height, which is like parents do with their kids. Kids can stand next to it and go 'I'm taller than a 6 year old chimp'" (Woollard 2012).

Figure 11. Budongo stairs

The exhibition space contains two distinct narratives divided over the two floors, 'Chimp's Home the Forest', and 'Chimp's Home the Zoo' (Woollard 2012). Characters within the narrative theme are provided by the chimps themselves, who are featured in an introductory slideshow and portraits on the stairs. These characters are not used as interactive agents or guides but, tell visitors the chimp's names, describe character traits, and emphasise the family aspect of the chimp's social group, which may help visitors relate on a more personal level.

At a zoo interpretation faces a challenge not met at other sites; competing for visitors' attention with live animals. Interactive interpretation can add to a zoological exhibition experience by enhancing, extending and interconnecting knowledge, however, the attraction of living plants and animals is fundamental (Robinson 1998). Visitors come to see real things (objects, artefacts, animals etc.) and not the presentation media (Thomas 1998). As Lorentz (2006:104) describes, visitors in this context are not a captive audience and may

move freely through the exhibition. Narratives may be read, reread or missed altogether and visitors may create their own meanings based on their own experience and the narrative elements they assess. Lorentz (2006:108-109) argues that an exhibition without a threshold, counter point or climax (mid-point) and exit sequence may have a disjunctive narrative style and lack the structural links that provide continuity and immersive impact. It is possible therefore, that subtle cues and narrative devices may be misinterpreted or missed completely, especially if visitors are primarily focussed on viewing the animals rather than engaging with the interpretative material. Visitor interaction with key elements, such as the visual cues on the staircase or interaction with exhibits, may provide evidence as to whether the narrative is being successfully communicated and engaged with; therefore, creating a more immersive experience.

Findings by Bitgood (2006) indicate that fewer visitor stops occur when exhibits are placed on both sides of a visitor path. Approach and stop behaviour was more frequent with exhibits placed only on one side. It therefore seems plausible that visitors may forego engagement with interpretation in favour of the 'main attraction', i.e. the animals. Previous studies have also indicated that visitor engagement of educational signage is generally low at zoos (Schnackenberg 1997; Coll *et al.* 2003; Parker 2006). Design of signage and exhibits may be key to persuading visitors towards zoo messages by using fun facts, thought provoking questions and interactivity; the use of technology and relating with the visitor may make signage more attractive (Parker 2006:41). Talks by zoo staff can also be one of the most effective ways of message communication, although potential difficulty lies in the amount of staff time dedicated to visitor interaction (Parker 2006:42).

To this end the exhibition as a whole is designed to be a multi-sensory experience, beginning with the bespoke building and grand entrance. Experiences are intrinsically sensory and the stimulants that accompany an experience should support and enhance its theme, making it more memorable (Pine and Gilmore 1999:59).

Once in the exhibition space visitors have a number of choices they can make with regards to their interactions with the narrative theme. The large chimpanzee viewing windows are at tree height, level with the chimps, and provide excellent views of all habitat areas. Interactive exhibits and multimedia displays are used, which present visitors with more hands-on opportunities than Main Street or Culloden. These focus primarily on highlighting the intelligence of chimps and their similarities with humans. Hands-on exhibits like touchscreens, smell units, videos, touchable hand prints, and a statue of a chimp, as well as talks and touch-tables run by staff all provide a rich learning environment with multiple modalities (see figures 12 and 13). Such depth of interpretation, and the more media used to communicate, has the potential for greater cognitive impact (Crigler *et al.* 1994; Crowest 1999). Experiencing multiple layers of interpretation at zoos can enhance the perceived impact on the visitor. However, the standard of interpretation, capabilities of staff and volunteers, and the types of media used also affect impact (Weiler and Smith 2009).

Figure 12. '98% Human' hand prints and anatomy interactive.

Figure 13. '98% Human' memory game and 'Eddie Says' animation.

Maintenance is costly however, with wear and tear a constant issue for such exhibits (Brochu 2003). At the time of this study some individual exhibits were damaged or non-functioning including the smell station at the entrance and the tools interactive (figure 14). Broken exhibits can lead to frustration and disappointment, creating negative cues, with functionality being a primary concern for visitors over other maintenance issues (Kollmann 2007:187). In this instance only the tools interactive was completely non-functioning and was repaired before completion of this study.

Figure 14. Exhibit maintenance

4.2 Main Street

The Main Street exhibit is best defined as a reconstitution model of immersion (Mortensen 2010:325) seeking to reproduce an existing reference world, encompassing elements of Bitgood's (1990, 2011) simulated, media and interactive environments. Unlike Budongo Trail and Culloden, Main Street has two potential threshold points for visitors, however, both are designed to provide very similar experiences. Scale, detail and authenticity are designed to create a sense of wonder and awe; the realistic recreation buildings are of authentic height at three stories and lit atmospherically by overhead lights and light emanating from shop windows and signs. At either entry visitors are met by horse drawn carriages, one a tram and one a hearse (see figure 15). Shop window displays are brightly lit and several, such as the pawn shop and saddlers are crammed with interesting items. These thresholds also have a stark contrast with the rest of the museum, which is modern and full of categorised and itemised displays. Visitors are self-selecting, there is no set or recommended route through the museum and this contrast provides a strong level of saliency designed to draw visitors in.

Figure 15. Main Street entries.

The overarching narrative is that of Glasgow's high street heritage, on which the multiple narrative strands provided by individual shop exhibits are based. Each shop communicates an individual strand within the overall narrative, which is delivered through various media, each unique to the exhibit and often includes characters both real and fictional. For example, the Photographer's individual narrative sees visitors engaged in getting their portrait taken. They are led by the virtual character of the photographer on a large screen. He explains how the image will be taken and invites participants to select backgrounds and pose. The photo is taken and visitors are able to view their finished image on a different screen seconds later. In the 'Mitre' Pub visitors are witness to an altercation between inebriated patrons through audio and visuals on a screen behind the bar. Unlike the Photographers there is no interaction between these virtual characters and the visitors, and the scene is repeated automatically.

Engagements with visitors like these directly involve them and relate to prior knowledge and experience. The bar scene avoids any possible intimidation or discomfort simply by placing the visitor as a spectator rather than a participant and the audio is not so loud as to be intrusive if visitors wish to ignore it and look around the exhibit. Conversely the Photographer actively engages the visitors through direct involvement and communication. Other exhibits do not seek to actively engage visitors, thereby increasing the salience of those which do, and create an immersive environment by reconstructing shops which visitors may enter.

Visitors also have an inherent effect on the narrative structure of their visit as there is no set route and they may approach or enter buildings and features freely. As well as contributing to the authenticity of the street, such freedom allows visitors to engage with the four experience realms of the exhibit (aesthetic, educational, entertainment, escapist) to a degree which suits them. This may help to create the balance and interaction of these elements required to achieve Pine and Gilmore's (1998) "sweet spot".

There are many options and opportunities for sensory experiences within the exhibit with the experience of being part of the exhibit a key contributory factor. In addition to labelled objects to see there are audio, visual and hands-on opportunities in almost every part of the exhibit to varying degrees. Some shops include counters and seating which may be used and touched. In the Subway visitors can use a grip control to experience what it was like to start and stop an early 20th century subway train, as well being able to sit in the carriage.

The virtual characters in the Photographer and Pub form part of the sensory experience of those exhibits and there are several interactive points with games and audio-visuals. The Café exhibit individually represents a genuine reconstruction of a real place, featuring the actual fittings and seating from the reference building. While sitting at booth, visitors can watch several short audio-visuals which are narrated by the granddaughter of the shop owner who describes daily life both in the café and the time of operation. This adds an extra level of connection as some visitors may remember the café when it was in operation in Glasgow, while for other visitors, being able to touch and use the genuine environment may help to create a sense of place and time.

4.3 Battle Immersion

The Battle Experience (figure 16) aims to create a simulated immersion environment by using techniques commonly employed by media immersion exhibits (Bitgood 1990; 2011), in that audio-visual presentation is the key approach. Participants are self-selecting; visitors who elect to enter the exhibition space at the start time of a showing must open a door into the area which closes behind them. Visitors may enter the area at any time but, missing the beginning of the showing may impact on the experience as some of the narrative devices designed to create tension and communicate plot will be missed. The effect of visitors entering at unscheduled times, either upon their experience or the experience of visitors already in the exhibit, is mitigated by a screen above the entrance which displays how long it will be until the next showing.

Figure 16. The Battle Room (Electrosonic 2013)

The film consists of a simple, clear narrative depicting the Jacobite defeat without verbal or text narration. The film itself represents the climax or counter-point of the overall site narrative, which is designed as a linear experience (Brochu 2003:111); while visitors have the freedom to stop, repeat and ignore sections, they must pass through the galleries in order. Visitors make their way through the galleries and by the time they reach the battle room should have gained at least some contextual knowledge if they have read even the introductory panels to each gallery. The narrative within the film contains devices designed to create tension and provoke emotional reaction. For a time nothing is shown but grass on the moor blowing in the wind (with sound). Then, slowly, troops start to appear on all sides. It is then some time before the action happens, which is loud, graphic and finishes abruptly. There is then silence other than the sound of wind as the Government troops pick their way over the fallen Jacobites before the screen fades back to the initial image of the moor. Visitors leave through a narrow corridor with the names of men killed at Culloden written on the walls. Visitors are not obliged to leave and may remain for as many showings as they wish.

As well as being visually and acoustically isolated visitors are completely surrounded by moving images and loud noise. In addition, the use of spatial devices is a key factor in helping to enhance the effect of the sensory experience and create an immersive environment, as visitors are given no option but to be surrounded by these devices. The use of these aesthetic devices may create a sense of wonder, awe, discomfort or disorientation. These attributes may also add to the entertainment value of the exhibit (Pine and Gilmore 1998) and may complement the effect of the narrative (escapist) elements. Visitors are isolated from the rest of the exhibition and engaged on a multi-sensory level with loud noise and graphic imagery from all sides. These properties may cause feelings of discomfort or perhaps even disturb some visitors. This presents an opportunity for cognitive dissonance to occur (Festinger 1957), whereby visitors are confronted with conflicting sensory information. This type of cognitive dissonance (Festinger 1957), sometimes called "heritage dissonance" (Lennon and Foley 2000:52) or "hot interpretation" (Uzzell and Ballantyne 1998:1), often occurs in the interpretation of atrocities and sites of controversy, called 'dark tourism', with the aim of influencing the attitudes of the visitor.

The Battle Experience provides all the necessary components for an effective immersive experience in relation to Lorentz (2006), as well as containing elements which represent Pine and Gilmore's (1998) four realms of experience. The richest experiences are at the point Pine and Gilmore call the "sweet spot" (Lorentz 2006:53) which is achieved by creating perfect balance between these elements. The fact that experiences by nature are subjective is unavoidable; however, the provision for all these complementary elements may ensure that the Battle Experience is immersive and effective with strong potential to provoke flow and aesthetic experiences.

5. Data and results

5.1 Budongo Trail observation

5.1.1 Budongo sample

Observations were conducted on several days over a period of several weeks in order to achieve both the desired numbers over the time period recommended by Diamond *et al* (2009) in order to collect a representative sample.

The dominant age ranges of visitors were 18-25 and 26-35, with significantly more observed in these than others. There is a degree of subjectivity in these figures however, as due to the nature of observational study age was estimated by the researcher. The number of males and females was roughly equal. The total sample size at Budongo was 54, which is within the ideal sample size identified by Diamond *et al.* (2009:58).

Date	Male	Female	Total
16.01.2013	6	4	10
16.02.2013	5	7	12
19.02.2013	4	6	10
01.03.2013	6	6	12
08.04.2013	7	3	10
Totals	28 (52%)	26 (48%)	54

Table 4. Zoo sample – gender

Date	18-25	26-35	36-45	46-55	56-65
16.01.2013	6	1	2	1	0
16.02.2013	7	4	1	0	0
19.02.2013	2	2	5	1	0
01.03.2013	3	8	0	0	1
08.04.2013	5	1	1	2	1
Totals	23	16	9	4	2

Table 5. Zoo sample – age groups

5.1.2 Dwell times and frequencies

The results of the observational study are detailed in tables 6 and 7. This includes total frequency, percentage of visitors overall and average dwell time at each exhibit. These figures are demonstrated visually in figures 17 and 18.

Frequencies represent the total number of visitors who 'attended to' the specific exhibit. The percentage indicates what percentage of the sample each frequency represents. For example, 50% of visitors 'attended to' Pod 1, which was 93% of the total sample at Budongo. From the frequencies data we can see that the three chimpanzee Pods and the 98% Human interactive were the most 'attended to' exhibits at Budongo.

Dwell times indicate the length of time each exhibit was attended to on average by those visitors who 'attended to' each. The % of visitors who 'attended to' each exhibit is presented on the right. From this comparison we can see the highest frequencies did not always result in the longest dwell times. For example, the staffed table at Budongo achieved a significantly higher average dwell time than any other exhibit, but was 'attended to' by only 15% of visitors. However, Pod 1 received both high frequency and long dwell times.

Exhibit	Frequency	% of Visitors
Pod 1	50	93%
Pod 3	33	61%
98% Human	27	50%
Pod 2	25	46%
Lecture Hall	20	37%
Smells	19	35%
Meet The Family	14	26%
Research	10	19%
First Aid	10	19%
Stairs	10	19%
Staffed Table	8	15%
Forest Panel	6	11%
Memory	5	9%
Eddie Says	4	7%
Signage	4	7%
Ape Vine	2	4%

Table 6. Budongo Trail frequencies

Exhibit	Average Dwell Time (seconds)
Staffed Table	169
Pod 1	97
Lecture Hall	90
Pod 3	79
Ape Vine	53
98% Human	50
Signage	35
Eddie Says	31
Memory	28
Meet The Family	26
Forest Panel	25
Research	23
Pod 2	21
Stairs	21
Smells	20
First Aid	17

Table 7. Budongo Trail average dwell times

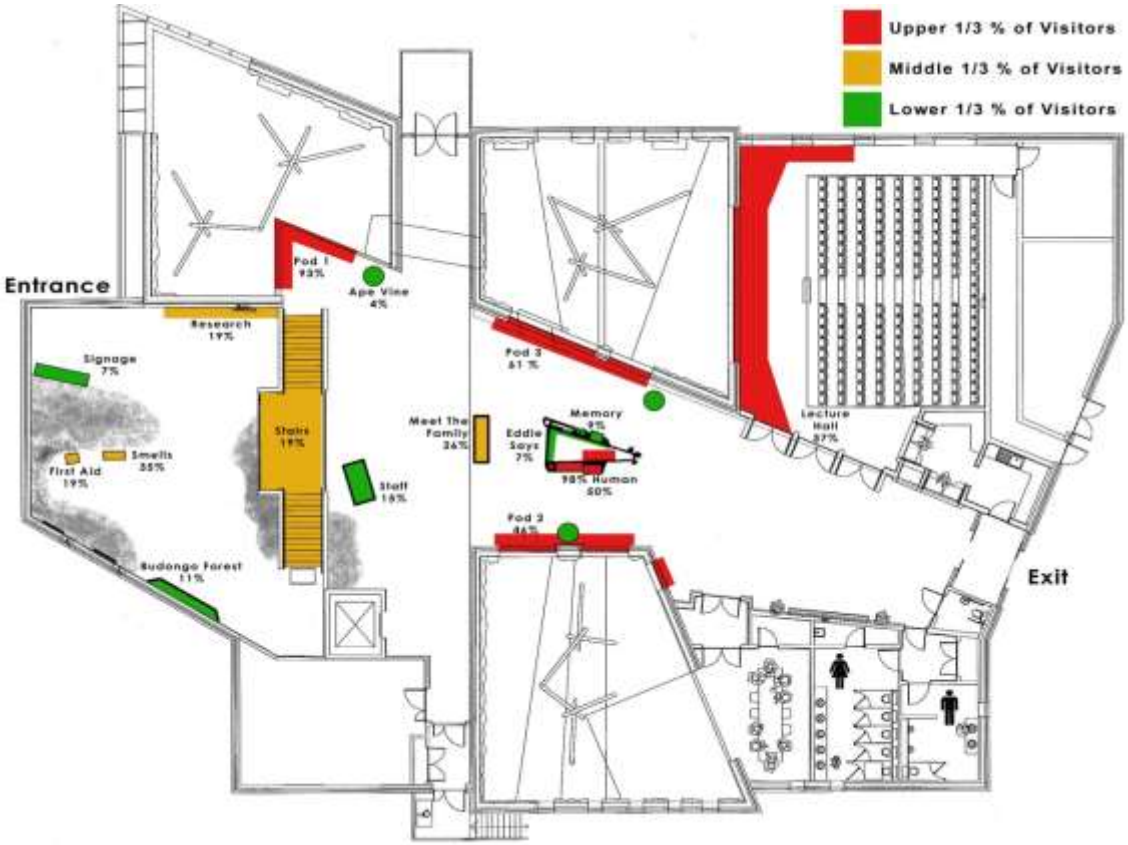

Figure 17. Budongo frequencies map

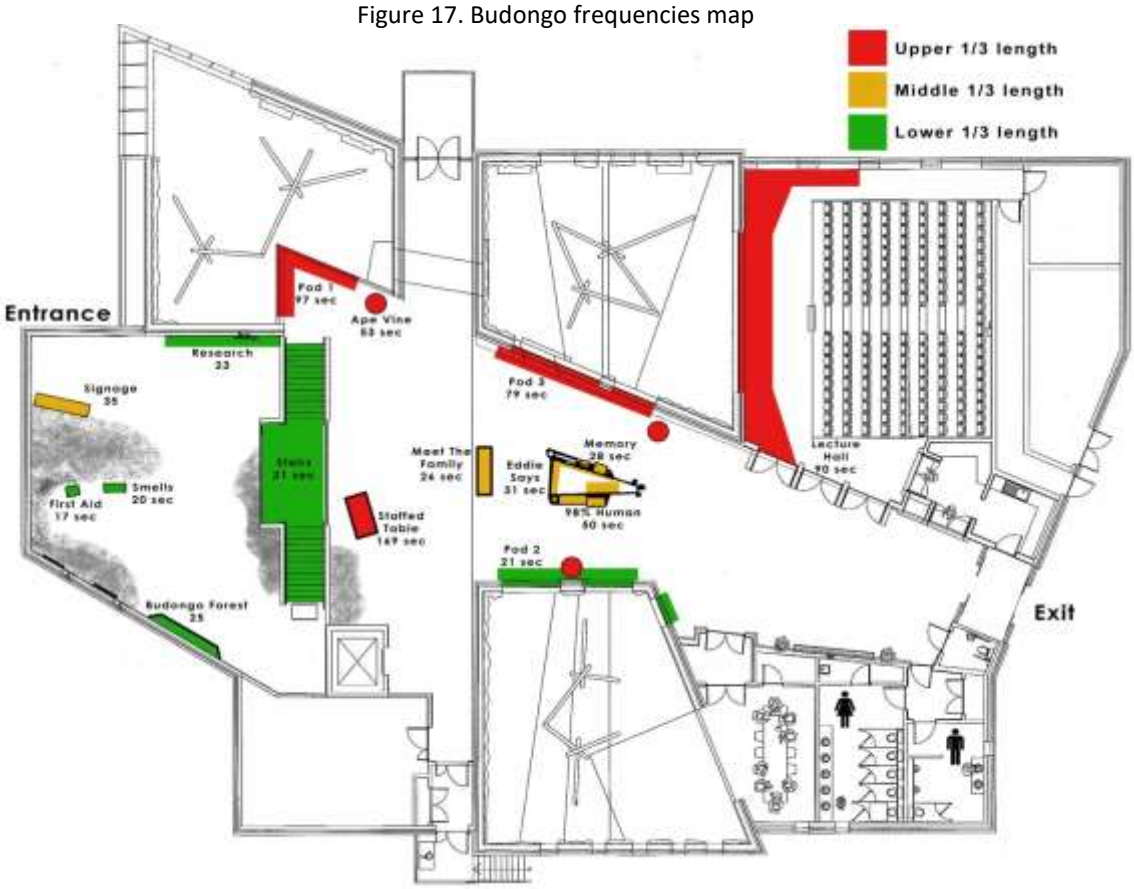

Figure 18. Budongo dwell times map

5.1.3 Budongo routes

The movements of each individual visitor observed were digitally recorded on a plan of the site. Visitor movements were recorded from entering the exhibition space until the moment of leaving, either through the exit, back through the entrance or leaving the area to use site facilities.

Figure 19 shows all 54 observed routes overlaid on the site plan which was used for tracking visitor movements. Each line represents the movements of one visitor, and the transparency of each route has been adjusted so that darker areas indicate areas of higher use.

Figure 19. Budongo routes

5.1.4 Budongo indicators

Visitor behaviour whilst 'attending to' each exhibit was categorised according to indicators provided by Gammon (2003:8) and is summarised in the table below which shows the percentage of visitors who 'attended to' the exhibit for each indicator. The headings 1, 2 and 3 indicate weak, medium and strong levels of engagement which indicate a lesser or greater likelihood of learning occurring respectively. Visitor behaviour while 'attending to' was categorised according to guidelines stated by Gammon (2003:8). Average dwell times are shown in the right hand column.

		% of visitors displaying indicator			Average dwell time (seconds)
Exhibit	**# of visitors**	**1**	**2**	**3**	
Pod 1	50	34	24	42	97
Pod 3	33	42	28	30	79
98% Human	27	30	33	37	50
Pod 2	25	80	12	8	21
Lecture Hall	20	20	25	55	90
Smells	19	48	47	5	20
Meet the Family	14	57	36	7	26
Research	10	80	20	0	23
First Aid	10	50	30	20	17
Stairs	10	50	40	10	21
Staffed Table	8	12	13	75	169
Forest Panel	6	50	33	17	25
Memory	5	80	20	0	28
Eddie Says	4	75	0	25	31
Signage	4	25	50	25	35
Ape Vine	2	0	50	50	53

Table 8. Budongo Trail indicators.

5.2 Main Street observation

5.2.1 Main Street sample

Again, observations were conducted on several days over a period of several weeks in order to collect the representative sample identified by Diamond *et al.* (2009).

In this case the number of males observed outnumbered females, and the numbers of visitors observed in each age group are similar (15-23%) with the exception of the 66+ range. Again, these figures are subject to a degree of bias due to ages being estimated by the researcher.

Date	Male	Female	Total
05.02.2013	7	5	12
23.02.2013	5	3	8
26.02.2013	9	6	15
05.03.2013	8	4	12
09.04.2013	8	7	15
Totals	37 (60%)	25 (40%)	62

Table 9. Main Street sample – gender

Date	18-25	26-35	36-45	46-55	56-65	66+
05.02.2013	3	3	2	2	2	0
23.02.2013	1	0	3	4	0	0
26.02.2013	3	4	3	2	1	2
05.03.2013	1	4	0	3	4	0
09.04.2013	1	3	3	2	3	3
Totals	9 (15%)	14 (23%)	11 (18%)	13 (21%)	10 (16%)	5 (8%)

Table 10. Main Street sample – age groups

5.2.2 Dwell times and frequency

The results of the observational study are detailed in tables 11 and 12. This includes total frequency, percentage of visitors overall and average dwell time at each exhibit.

Exhibit	Frequency	% of Visitors
Pub	33	53
Subway	28	45
Pawn Shop	20	32
Café	20	32
Cabinet Maker	17	27
Saddler	16	26
Photographer	14	23
Hearse	14	23
Bootmaker	13	21
Tram	12	19
Car	11	18
Dress Shop	5	8
Truck	5	8
Carriage	1	2

Table 11. Main Street frequencies

Exhibit	Average Dwell Time (seconds)
Café	147
Subway	92
Photographer	84
Pawn Shop	72
Cabinet Maker	66
Pub	59
Saddler	36
Bootmaker	30
Dress Shop	26
Tram	20
Hearse	15
Car	13
Carriage	10
Truck	8

Table 12. Main Street average dwell times

Figure 20. Main Street frequencies

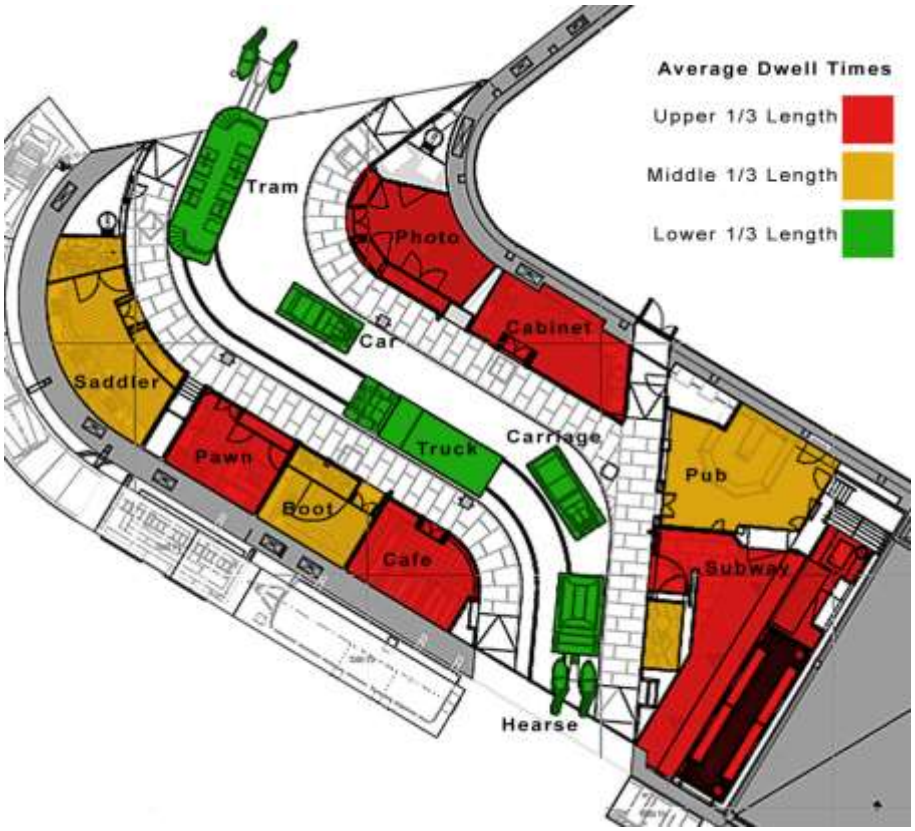

Figure 21. Main Street dwell times

5.2.3 Main Street routes

Figures 22 and 23 show the routes of all 62 observed visitors overlaid on the site plan used for movement tracking. At Main Street there are two possible directions for visitors to enter and exit the exhibition area (denoted by green arrows in figures 22 and 23); one from the direction of the main entrance from the top of the plan, and one towards the main entrance from the bottom of the plan. Again, darker areas indicate areas of higher use by visitors. Although there are two possible directions from which visitors may enter the area, the data shows that the use of space is similar and consistent between the two data sets.

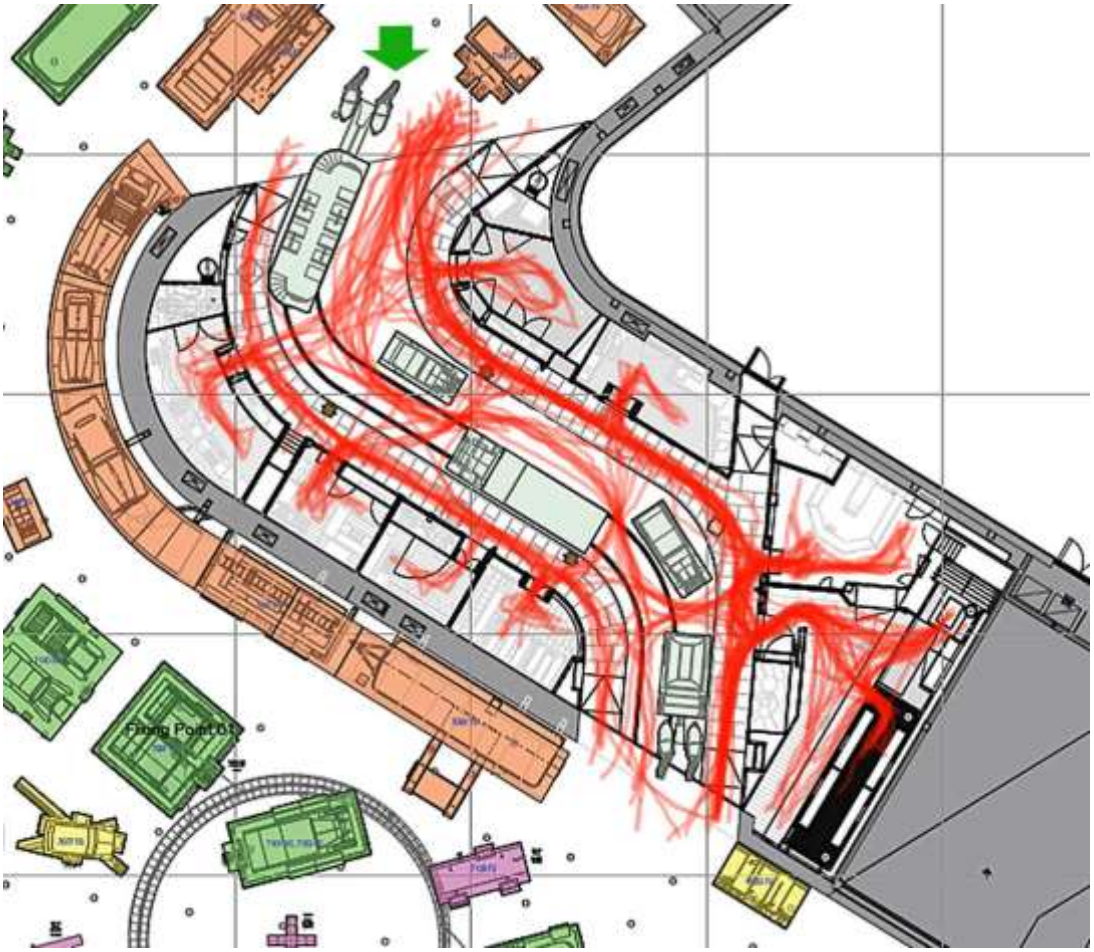

Figure 22. Main Street routes from main entrance

Figure 23. Main Street routes towards main entrance

5.2.4 Main Street indicators

Visitor behaviour while 'attending to' each exhibit was categorised according to indicators provided by Gammon (2003:8).

Exhibit	# of visitors	% of visitors displaying indicator 1	2	3	Avg dwell time (seconds)
Pub	33	42	49	9	59
Subway	28	36	46	18	92
Pawn Shop	20	30	40	30	72
Cafe	20	55	10	35	147
Cabinet Maker	17	47	35	18	66
Saddler	16	69	25	6	36
Photographer	14	57	14	29	84
Hearse	14	71	29	0	15
Bootmaker	13	84	8	8	30
Tram	12	50	42	8	20
Car	11	82	18	0	13
Dress Shop	5	80	0	20	26
Tuck	5	80	20	0	8
Carriage	1	100	0	0	10

Table 13. Riverside indicators

5.3 Analysis

5.3.1 Budongo Trail

At Budongo Trail the longest dwell times appear to accompany stronger indicators of learning and there were five components which generated average dwell times of over one minute, three of which were chimpanzee Pod viewing areas (Pod 1, Pod 3 and Lecture Hall – which overlooks Pod 3). The Staffed Table, the Chimpanzee Pods and the 98% Human interactive also generated the strongest indicators of engagement. Although the Ape Vine stations generated strong indicators the frequency was extremely low; only two visitors 'attended to' them, which does not enable the inference of a pattern.

The component which produced the longest average dwell time by a significant margin was the staffed table, which was available on the dates of 1/3/2013 and 8/4/2013; the last two days of observation. Although this produced a frequency of only 15% overall, on these days alone the frequency was 27%. This variation is a key point, and could be better explored over a longer period, with the table being staffed on every day of observation to confirm that the larger frequency is not anomalous. The engagement indicators from the staffed table were also high, with 75% of visitors who engaged exhibiting strong indicators.

Visitors also appear to generally follow the same route through the exhibition space, bypassing much of the interpretation and favouring a route past the chimpanzee viewing areas (figure 19). Below, a most common route has been generated from the data (figure 24), with the most frequent route in red, and less frequent routes in purple. In order to engage with the interpretation visitors must diverge from this desired route. 98% Human (shown in green) lies on the route between Pod 3 and Pod 2, which may explain the larger dwell time and frequency figures for this exhibit. This also shows that placement of interpretation along the visitors' desired route may increase the likelihood of engagement.

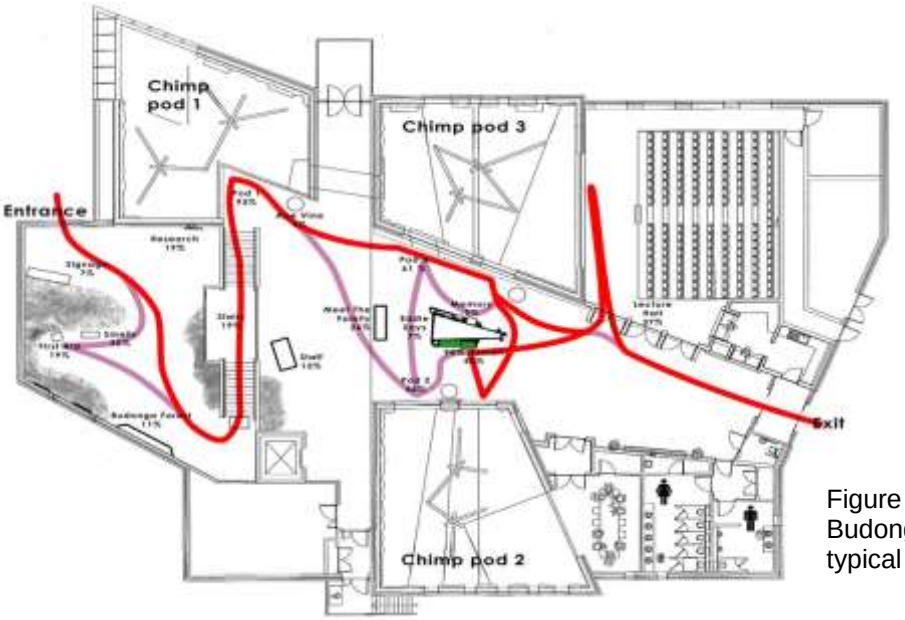

Figure 24. Budongo typical route

5.3.2 Main Street

At Main Street dwell times are consistent throughout the exhibition space, and are not skewed significantly towards a small number of components. However, the data suggests that exhibits which contained a higher level of interactivity or multi-media attracted higher frequencies and longer dwell times, and the exhibits which attracted higher frequencies also stimulated the longest dwell times. For example, the Café attracted over one third of visitors and the longest average dwell time. This may be partially explained by a small number of visitors who watched all the audio-visual material, which lasts over ten minutes. While the Pub attracted the highest frequency dwell times were not proportionately as high, which also supports the idea that interactivity stimulates engagement, as the Pub does not have as much supporting or interactive material as exhibits which generated longer dwell times. While the vehicles received the shortest dwell times and lowest frequencies their true contribution to the overall aesthetics and authenticity of the exhibition may be far different than these figures suggest.

The data shows that although average dwell times were high for many of the exhibits, weak or medium indicators were more likely to be generated; most exhibits stimulated a large number of weak and medium indicators, with the photographer, pawn shop and café generating strong indicators in 29-35% of visitors. The highest number of strong indicators was generated by the café exhibit (35%). This data corroborates the idea that interactivity and multimedia can generate high levels of engagement, with exhibits containing these elements generating stronger indicators. The Pawn Shop, which features an interactive and a large number of small objects and narrative strands, also generated a high number of strong-medium indicators. This appears to suggest that exhibits containing a lot of objects, visual material and labels can also achieve high levels of engagement. Writers such as Walsh-Piper (1994), Duncan (2005), and Maki-Petaja (2012) argue that such devices can contribute to aesthetic experience and enhance visitor experience.

The data from section 4.5.2 has been collated to generate main route maps (figures 24 and 25 below). The data also shows that visitors' use of the exhibition space was consistent, and quite evenly spread, with most visitors covering a large proportion of the space. No clear common visitor route was revealed through movement tracking, although the road and pavements received more use as they are the main thoroughfare through the exhibition from which the individual exhibits are accessed.

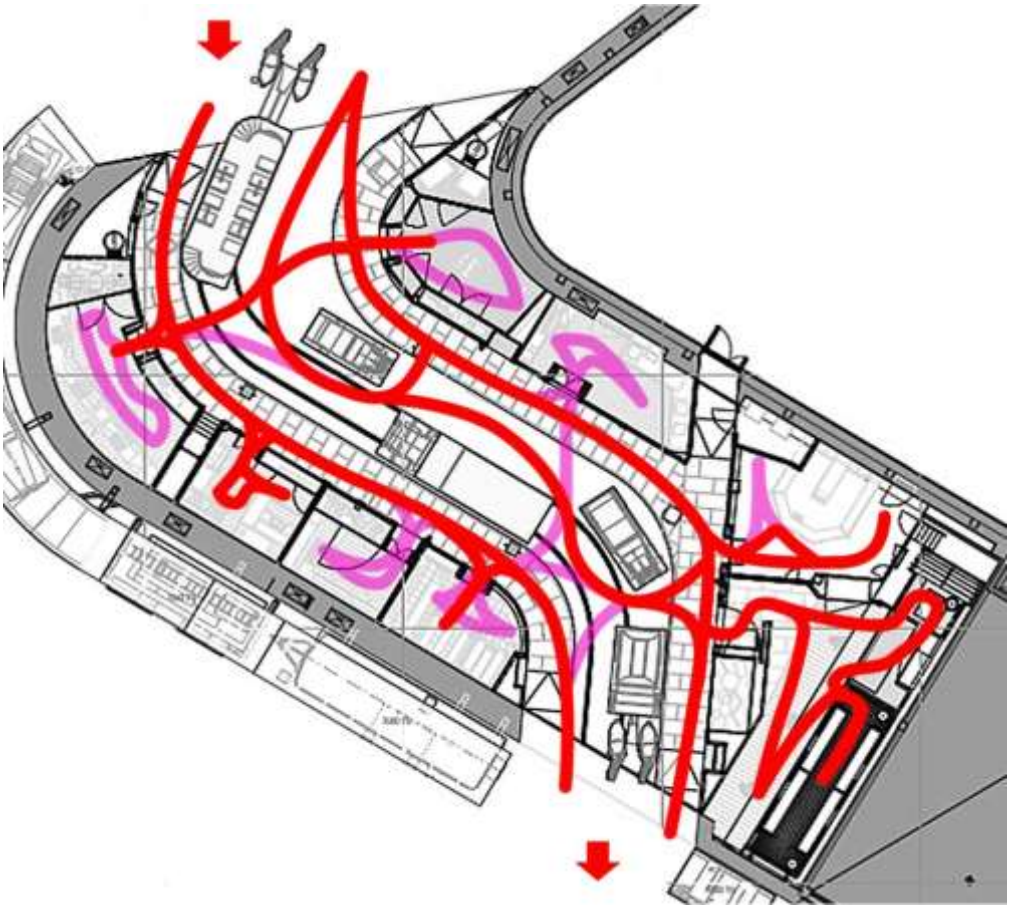

Figure 25. . Routes from direction of main entrance

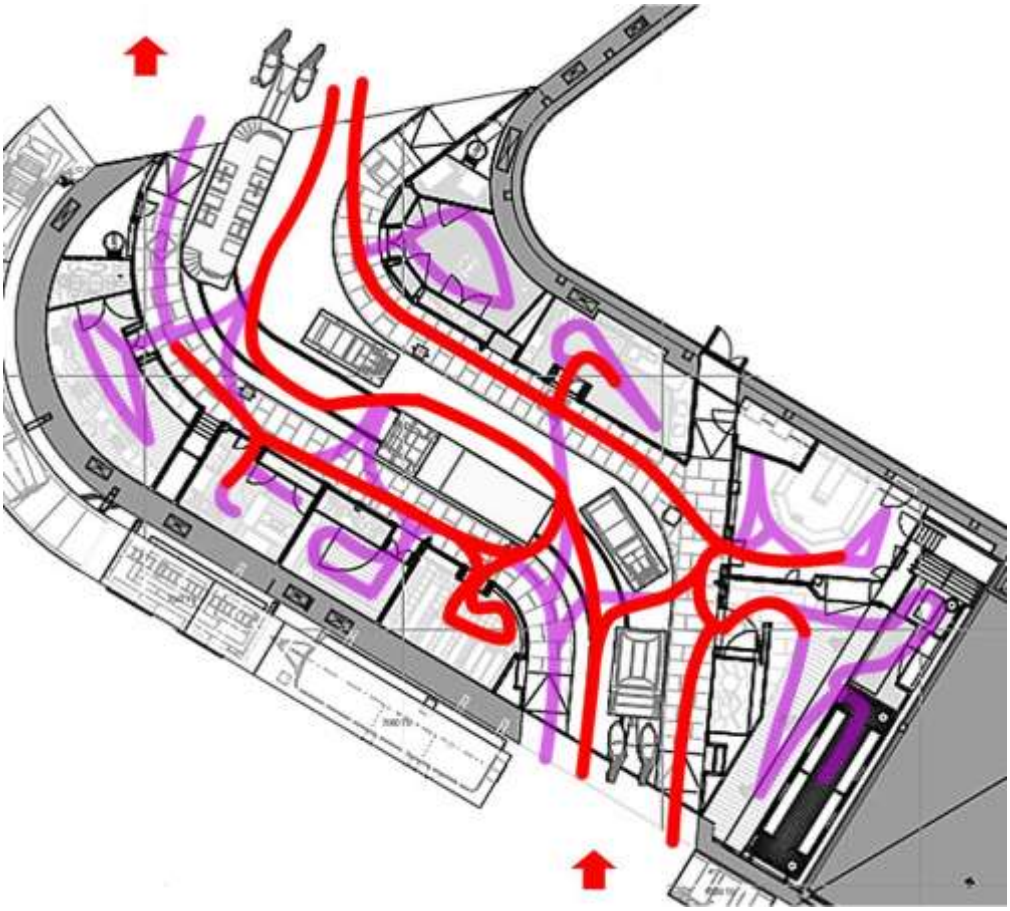

Figure 26. Routes towards main entrance

5.4 Interviews

Interviews were conducted on site as per the methodology, set out in 3.7. Full transcripts of all interviews and the questions are included in appendix 2. Interviews were recorded and transcribed afterwards into WEFT Qualitative Data Analysis program for Windows. Interviews were semi-structured and included questions regarding visitors' reactions to the site, aiming to investigate responses to site aesthetics, as well as collect information in order to gauge emotional response and visitor engagement. What the visitors did during their visit, which exhibits interested them and why, was examined. Questions were designed to be open in order to gather as much detailed as possible. This was particularly important at Culloden, as observational data was not collected. At Budongo and Main Street questions were designed to provide additional information which could not be collected through observation. Responses were grouped in terms of key themes using the WEFT software and although these key themes were somewhat site specific, they were generalised into the areas of: aesthetic and environmental reactions; emotional response; route choice; the role of the visitor; authenticity and realism; and evidence of connection to the exhibit.

5.4.1 Budongo interviews analysis

A total of nine interviews were conducted at Budongo trail on May 2nd 2013 and four respondents (male 25-30, female 25-30, female 40-50 and male 50-60,) declined to participate. Interviews were conducted in situ in order to give visitors a visual aid to the questions. Questions were open ended and semi-structured with a view to allowing visitors to comment on any aspect and to afford opportunity to record information on unforeseen and intangible aspects.

Several key themes became apparent through the interviews:

- There is a perception among some visitors that interactive exhibits, games and touchscreens are intended for children (respondents 1, 2, 4, 5, 6, 7, 8). As indicated above, several visitors indicated that they perceived the interactive elements to be aimed at children. It was also expressed that it is good for children to have access these types of interpretative elements, and that bringing children also encouraged some adults to engage with these elements. This may also explain the tendency for visitors to avoid the interpretation which was revealed in the observational data.

  "we're probably mostly just coming to see the chimps, although we spent a bit of time with the children today on the interactive bit, and maybe we [wouldn't have] done that before…you're sort of guided by the children…they like the bit at the front with the big screen there (referring to Eddie Says)." (2)

  "It's very good yeah, great for the children (gestures to the interactive interpretation area)." (6)

"I think the interactive bit for the children is good…[I didn't look] in any detail, just thought that looked quite good. I think it's mainly for kids to see, you see kids come in and tend to gravitate to that sort of thing so that's good." (7)

"No, we're too old! It's all for youngsters really isn't it?" (8)

- Interaction, with staff or exhibits, is appreciated (4, 5, 6, 9).

  "things like the lady over there (volunteer at touch table) explaining everything about what you're actually doing is marvellous, you know you can make sense of things and stuff like that…that sort of thing's great. That's why we wanted to go on a tour you know, I mean obviously you can read but hearing it and watching it at the same time is so different. It's far better to have someone to really interact with you know, because, even if you're viewing it and you see something there might be a specific reason why [the chimps] are doing it, whether it be like part of their mating or just grooming you know, stuff like that. It's great to have somebody at hand explaining things. It's not very often where you get like the little stalls over there (touch table) where you can actually touch and see things and get it all explained to you so that by far is I would say, I mean all this is great, but having that lady there just to explain what's happening." (4)

- Some visitors are playing a facilitator role when bringing children (2, 3).
- Visitors expressed that seeing the animals was their main visit priority (1, 5, 6, 8).
- Some visitors verbally corroborated the observed typical route from the observational study (4, 5, 6, 7, 9).
- Some visitors considered building aesthetics, exhibition and enclosure environments different to the norm. There were differing attitudes towards the aesthetic aspect (all respondents), i.e. people reacted initially to different things such as the smell and the lighting.

  "It's modern, not sure how to put it into words, it's modern looking but at the same time it's like, it kind of feels like a fun, colourful thing, place, for everybody really. It's very informative, colourful and it's got that feel for everybody" (1)

  "When we first came here though it was actually a vast improvement from what they had before, so it was really good just to see it, plus it was more spacious. I think just the space more than anything [made an impression on me], the sort of general size of it, and there's more space for the monkeys themselves, which made a huge difference, and you've got a better view." (2)

  "It stinks! That was the first thing that got me." (5)

"dark and dingy you know…that's certainly the impression. There's just a lack of light really, lack of natural light, but maybe that's just me being an outdoor type." (7)

- The pandas were the initial attraction to the zoo for some visitors (4, 6, 8).
- The activity level of the chimpanzees may affect the visitor experience (4, 5, 6, 7) as some visitors expressed displeasure when the chimps were inactive.

"Well it's very nice but obviously, you know, you can't make the animals do anything, so maybe on a nicer day they'd be walking and running about and stuff like that." (4)

"Bit disappointed that most of them seem to be asleep but I suppose you can't really do much about that yeah, they probably feel like us on a day like today! (5)"

"I think, obviously what people see will depend on what the chimps are doing…To be honest we just had a look round and came up to the door. We looked in each of them (the windows), looking in that wee bit (interpretation area) and wandered round and came to this bit here. We couldn't really see any animals." (7)

The size and scale of viewing areas and the positive difference between Budongo and other zoo environments in terms of visible habitat and visibility for children was also remarked upon. Reactions ranged from the strong smell on entry to the lighting of the exhibition space. Some visitors described it as colourful while another described the entrance very positively but expressed vehemently that the upstairs area was dark, plainly decorated and lacking natural light (respondents 6, 7). This demonstrates that aesthetics is an intrinsically personal phenomenon. Only one respondent remarked negatively on this subject.

5.4.2 Main Street interviews analysis

Seven interviews were conducted at Riverside on May 8th 2013 and six respondents declined to participate (male 45-50, male 25-30, female 25-30, female 30-35, male 40-45 and male 20-25). As at Budongo Trail, interviews were conducted in situ in order to achieve fast responses and give visitors a visual aid to the questions. Questions were open ended and semi-structured with a view to exploring visitor route choice, what elements attracted them, and how they felt about the exhibit as a whole.

Several key themes were raised during the interviews:

- Site aesthetics: The level of interaction, sights and smells were all remarked on positively. Elements such as the large vehicles, the hearse, and the scale of the exhibit were impressive to some visitors (respondents 2, 4, 5, 6). The words "atmospheric", "exciting", "attractive" and "vast" were used by several respondents (1, 2, 3, 4, 6).

  "It's great, it's really atmospheric isn't it? I think we saw it (the street) at the old museum and I think it's fairly similar, very atmospheric, yeah, it's good." (1)

  "The café was good because you could go in and take a seat and there were videos to watch and the, you know the interior was very detailed and interesting, and in the subway you could, you know start up a train and stop it. The upholsterers (Cabinet Makers) was interesting because of the vintage of the property it looks like furniture as well, as if they'd made it themselves so I quite liked that…The subway's got lots of hands on things you know and you can almost picture being on the subway, and the café was interesting for us just because, I think because it's got a history of the people that ran it you know and the immigrant sort of history for them." (1)

  "It's quite exciting, it's old fashioned, it's not like anything you'd see nowadays…I think it's brilliant…and I like wee shops you can go into." (2)

  "excellent, I like the whole atmosphere of it, and the fact that it's so interactive and you can actually go into each of the shops." (3)

- The exhibit was considered authentic, realistic and detailed (2, 3, 4, 5, 6, 7). One respondent assumed that the pub interior was genuine (7). Other visitors were aware of the genuine interior of the café due to prior press publicity upon the museum opening (6).

  "they're all good illustrations, and of course for people of our age to a certain extent one can remember these types of shops from one's childhood so they don't strike me as being

particularly unusual you see. I would say they're all authentic, the way they've been done." (4)

"Well I thought it was marvellous, I think it gives you a real flavour of what things were like. It puts the various vehicles and things in context, with the old tram lines too. The children are enjoying it too." (5)

- Some visitors felt that the presentation style provided context to objects and made them more meaningful, creating a better understanding (5, 6). Some visitors liked the level of information and felt that it was good to have written material on panels as well as touchscreen information (4).

  "it really adds something to be able to see things in a context, definitely. I you had things just sitting out it wouldn't mean anything, but it's when you read, and you see the signs and you can relate back to what you're seeing. I mean thinking about the other part round there (rest of museum), you see the cars round there and they're lovely, they're absolutely great, but this in this situation is fantastic…you know, if you go to a cathedral or something like that, you're actually seeing the items in the cathedral, because if you took them out the cathedral and put them into a case somewhere else you've lost something. No this is brilliant, absolutely brillian.t" (6).

- The exhibit appeared to connect in some way with all respondents by engaging with their prior knowledge or with the narrative. This included personal memories, stories and tv programmes on similar subjects, as well as visitors describing interactions with exhibits and the characters within them, such as the photographer, pub and cafe.

  "My grandmother used to live in Partick…it brings back lots of memories. It was funny going into the pawnbrokers because at that time her husband had died…and left a whole hoard of children…on a Monday they would run out of money so she would send her son along with something to the pawnbrokers, which she would get back on the Friday." (3)

  "In 1962 I just started work then and I remember going on the tram and getting a ticket which said this is the last ride on these trams, then they dug it up. Aye it brings things back, it's great." (6)

- Questions on route choice indicated that respondents were attracted to the same elements as indicated in the observational study. When asked why they decided to enter the pub, café, photographer and subway one respondent replied;

"I think it was because the doors were open and they stood out a bit more maybe. We could see what was inside them I think, from outside, so that's why we went in." (2)

5.4.3 Culloden interviews analysis

Interviews were conducted at the National Trust Culloden Visitor Centre on Saturday and Sunday the 9th and 10th of March. Weekend timing allowed for a maximum number of visitors to be present as this study was conducted during the low-season period and travelling to Culloden multiple times was not feasible for the researcher. As visitors exited the screening area they were approached and asked if they would be willing to participate in an interview about the exhibit. It was made clear that the interviews would be concentrating on this exhibit alone and not the rest of the exhibition. Despite the low-season period the sample was mixed, with visitors from Scotland, England, Germany, Australia and the USA.

The interviews were designed and structured to gather information on visitor engagement and emotional reaction with the aim of investigating exhibit presentation and the potential for immersive experiences with aesthetic, entertainment, escapist and educational value.

Three key themes of the exhibit were explored during the interviews.

- Realism, the bringing to life of historical events and a better understanding of history through visual representation
- Effects of the presentation style
- Empathy, emotional evocation and emotional understanding

Respondents consistently commented on the realism of the presentation and the fact that it added authenticity and a different dimension to the exhibition as a whole. This was expressed through comments that the presentation brought the event to life and showed events, costume, weaponry and emotion authentically in context. (1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 15). Respondents also consistently related what they saw in the presentation to the rest of the exhibition and expressed that it gave them a better understanding of this information (1, 2, 4, 5, 7, 8, 12, 18).

"it's a good way to represent things as they really have been…it just makes clearer the picture, how it was at that time…the things that really happened. Not only the facts but it showed how it would be, the feeling standing there, how it felt at that time." (1)

"you feel as if you're actually, almost in the scene…a sense of almost being immersed and being in it." (2)

"I didn't know much about Culloden to begin with, so you can read it but you can't imagine what it would actually look like, and that changes from seeing it (the exhibit)." (3)

"of course it's an acted out representation, but, as I said before, when you read [about] it…it doesn't bring the atmosphere [of the film]." (5)

The responses indicate that the film succeeded in engaging audiences, making them feel more like participants than viewers. This also had the effect of a greater understanding and connection to the information from previous exhibits as well as the battle.

Only one respondent expressed that they were unconvinced by the presentation, stating that while the exhibition had successfully built up tension for them up to that point, the battle presentation did not reach their expectations. It is worth noting that this response was related specifically to the realism of the filmed sequence and not related to the presentation aesthetics, suggesting that while aesthetic cues may be effective, some visitors will see through them objectively.

"Because I felt it did look like a lot of people just dressed up re-enacting the battle. It was quite good but I felt it was a theatrical performance and so I didn't feel too emotionally disturbed by it…it looked quite a small affair, and I think I'd imagined far more people…obviously it was a reconstruction, you couldn't accurately reflect the number of people that were involved in fighting, but it ended up to me looking like a small skirmish rather than the big battle I was imagining going to happen." (14)

The interviews revealed that the presentation environment also had a significant effect on the emotional impact of the exhibit. Respondents expressed that the noise had a significant impact on them when asked what the most memorable aspect of the exhibit.

"The noise, the fact that you were so close to it, it brought it to life"
"it becomes much more real when you're there than when you're reading everything coming up to it, and suddenly 'wow!'" (13)

Respondents also expressed a sense of confusion or disorientation, stating that they were constantly turning around in order to see as much as possible. One respondent stated that they would have preferred it if only three screens had been used and another stated that they backed into a corner to see as much as possible. This may further emphasise the potential for this exhibit to make people uncomfortable by placing them in the middle of the action, using visual and audio cues to enhance the experience. A number of visitors said that this was a unique experience for them and that they had not encountered a similar exhibit before. This demonstrates the effective use of dissonance (Festinger 1957; Uzzell and Balantyne 1998; Lennon and Foley 2000) in this exhibit to create affect.

"you're encompassed by so much sound, so [many] visuals which is quite a unique thing, there's not many places where you can experience that, so in that sense it did feel, again, realistic, almost like in real life you wouldn't know where to look, you were jumping from one panel to the next" (8)

"I thought it was pretty intense, it was I suppose I kind of sensory overload, cause you're getting the four angles, the four sides and you're not sure where to look… if I was to describe it to wife, if she said should I go in or not, I would say it was pretty loud, pretty intense." (18)

"…actually by being in the middle of it you are completely disorientated, it's horrible because you keep having to move around to see everything, but then that makes you appreciate how it must have been for them because you don't know what's coming at you, you're not prepared, you don't know really what's going on….I just cannot imagine really how it must have been but I think that does go some way to putting you in that position, which as I say [was] horrible, I didn't feel comfortable in there actually…it was quite disturbing. I think that's obviously the whole purpose of it so it's right that it should be like that." (11)

It is interesting to note that people were often more open with their emotional experience when answering questions which were not about that aspect directly, for example about the way it was presented or what was most memorable. From the responses it is clear that feelings of empathy and a sense of connection achieved through the realism and high-impact design of the presentation were successfully achieved. Placing visitors in the middle of an experience which is overwhelming to the senses appears to have had a direct effect on emotional responses, increasing affect and creating a sense of immersion, rather than placing the visitor as a spectator.

This evidence suggests that the battle experience represents an example of an immersive exhibit which effectively presents aesthetic, entertainment and learning experiences and opportunities. This has the potential to significantly contribute to a visitor's experience by engaging visitors both emotionally and physically while providing a high degree of authenticity and context for the overall interpretation.

7. Discussion

This research has aimed to examine immersive experiences in exhibition spaces and investigate whether current examples are reflective of proposed theory and research on visitor experience, and whether these approaches are effective in engaging visitors. Through a mixed methods approach it has been possible to determine which elements are most effective at engaging visitors in each of three case studies and provide evidence as to why. Through observation, visitors' most common route choices and the areas of highest levels of attention were determined, while interviews were used in order to provide some evidence of the reason for any patterns.

7.1 Budongo Trail

At Budongo Trail the data suggests that the interpretation is receiving significantly less attention than the chimpanzees. This corroborates previous research which suggests that visitor engagement of interpretation at zoos is generally low (Coll *et al.* 2003, Parker 2006, Schnackenberg), despite Parker's (2006: 41) suggestion that engagement may be increased by the use of interactivity, technology and attractive signage. Two factors may help explain the level of attention afforded to the interpretation by visitors. Firstly, as discussed in section 4.1, visitors motivations may lie with seeing the real, live animals (Robinson 1998, Thomas 1998); a view corroborated by 44% of interview respondents. Data from four respondents also indicated that when the chimpanzees were inactive the visitors became less engaged. Data also indicated that visitors may be motivated by fulfilling a facilitator role (Falk *et al.* 2007), within which they may be guided by other visitors or children who may be more interested in seeing animals. Second, the interpretative media used may also affect engagement. Data from seven interview respondents indicated that there is a perception that interactive exhibits and games are aimed at children, which may have led some visitors not to engage.

The data, as shown in figure 24, suggests that visitors typically follow the same route. This typical route generally avoids the interpretation in favour of the chimpanzee viewing areas. This supports the argument which suggests that visitors are primarily there to see the animals (Robinson 1998; Thomas 1998). The data (figure 24) also indicates that some exhibits are able to generate attention but do not lie on the typical route. This indicates that layout, as well as media and motivation, may be affecting visitor engagement. For example, 98% Human may have generated more attention than other exhibits as it lies on the visitors' typical route, which led them from Pod 3, to Pod 2. The exhibit is also interestingly designed, featuring silver models of chimp and human skeletons, which may have affected attraction and attention. Certainly, some visitors took photographs of these and ignored the touch screen below, which indicates that it stimulates more of a visual engagement than an immersive one.

The one component which was able to exceed the dwell times generated by the chimpanzees was zoo staff, who were able to stimulate long dwell times on the days on which they were present. Interaction with live interpreters was shown to produce significantly higher average dwell times and 22% of visitors expressed liking this aspect in interviews. This corroborates previous research which found that interaction with zoo staff can be an extremely effective method of communication (Parker 2006) as they fulfil the role of a more knowledgeable other in Vygotsky's Zone of Proximal Development (Atherton 2011).

7.2 Main Street

Data from research at Main Street indicates that areas of higher interactivity and more types of interpretative media (i.e containing both written and interactive or audio-visual) correspond to higher levels of interest (dwell times and frequency). In addition the data shows that the use of space by visitors is broad and consistent across most areas, with the data showing inconsistent and varied routes across all areas of the exhibition. As shown by figures 25 and 26, there was no clear typical route.

The indicators of engagement may therefore distinguish the exhibits which generated greater engagement (Photographer, Café, Pawn Shop, Subway and Cabinet Maker). The higher levels of engagement may be explained by the fact that these exhibits contain several types of interpretative media. There is contextual information by which visitors may see, hear and touch genuine exhibits; interview data indicates that visitors found this authentic and detailed, and that providing context for the objects made it more meaningful to them. There is sufficient written information for visitors who prefer to read, which was corroborated by one interview respondent, and there are touchscreens, interactive games and audio-visual elements. Exhibits containing more objects or interactive elements generated the higher dwell times and the strongest indicators of engagement. Although almost all exhibits contain an element of interactivity the data appears to suggest that a higher level of interactivity, especially interactivity with virtual characters (the photographer, café video narrator and "cast" of the family) generated greater engagement. For example, the Pub contains no interactive elements, and a small element of audio-visual material. While it received the highest visit frequency it generated a medium/low average dwell time.

The data also suggests that the exhibition is capable of forming real connections with some visitors, which was evidenced to at least some extent, by all interview respondents. This is supported by long dwell times and high levels of engagement in exhibits which have a more contemporary connection to Glasgow, particularly the Café, Subway and Pawn Shop. Some respondents talked about the parallels between some exhibits and their own lives. For example, one respondent explained how his grandmother had used the local pawn shop every week, and another spoke about the feeling he got when viewing these shop fronts in a

museum; stating that to him they were not unusual and it was strange to see them in this context. The exhibition overall appeared to engage visitors' prior knowledge effectively and the data indicates potential for discursive learning experiences and individual meaning-making, reflecting the aims of constructivist museum exhibits (Hein 1995; Mason 2005).

7.3 Culloden Battle Experience

The data from 40% of respondents indicates that they were able to find connections between the rest of the exhibition and the experience. This indicates that the immersive experience is informed and influenced by the prior experience of the exhibition up to the point of the Battle Experience, evidenced by references to information not contained in the film as well as visitors' own prior knowledge of the events. These respondents felt that the experience gave them context and better understanding of this information, which suggests the experience may have a direct effect on learning.

The data also suggests that the Battle Experience is perceived by visitors as an authentic insight into what it may have been like during the battle. Data from 55% of respondents indicates a high degree of perceived realism about the exhibit and these respondents felt that it brought history to life, adding a dimension that could not be communicated by the rest of the exhibition. Responses indicate that this did not only include a greater understanding of the historical events but, also, a feeling of empathy for the combatants and a perceived greater understanding of their emotion, which demonstrates some success in creating personal connections between some respondents and the past. This is further emphasised by the data from 70% of respondents indicating that the exhibit was successful in evoking emotional responses including: shock; awe; disorientation; and sadness.

Data from 50% of respondents also indicates that the dramatic presentation style successfully affected visitors, with three respondents commenting on the loud, sometimes overwhelming noise.

The data appears to suggest that the dissonance created by effectively engaging visitors on a multi-sensory level contributes to a strong emotional affect. This corroborates data from the observational study which indicated that multi-sensory components were effective at engaging visitors.

8. Conclusion

While there are many examples of immersive experiences in exhibitions this study has examined three different examples of this approach and provided evidence to support the hypothesis that immersive experiences can be effective at engaging and affecting visitors. However, as this study has shown, different approaches receive different reactions from visitors and variables such as visitor motivations, interpretative media and competition with other elements can influence visitor engagement. All three sites have components which can attract and engage visitors. Main Street and the Battle Experience appear to succeed more at forming connections through multi-sensory engagement. While the interpretation at Budongo Trail appears to compete with the chimpanzees for visitors' attention, staff are an effective method of providing interpretation and engagement as learners may seek a more knowledgeable expert.

8.1 Engagement over aesthetics

Further research is required to establish exactly the types of immersive environments which are most effective, and how visitors' emotions may be accurately targeted. However, this study has provided evidence that the level of environmental and multi-sensory stimulus influences the level of visitor engagement in immersive experiences. While aesthetics may be effective at gaining visitors' initial interest it is the multi-sensory elements which appear to generate longer engagement. Providing opportunities for multi-sensory engagement and multiple learning modalities (visual, auditory and kinesthetic, i.e. touch and direct interaction) appears to generate longer dwell times and higher frequencies, thereby increasing the likelihood of learning (Gammon 2003). To engage visitors, interpretation must incorporate effective aesthetic, multi-sensory and interactive elements. Visitors' reactions to these elements are intrinsically personal and varied, but, incorporating a wide range of carefully designed devices can increase the likelihood of communicating with the audience.

Uzzell and Ballantyne (1998:11) argue that interpretation should cater for those who find the interpretation evocative as well as those whom it is a intellectual encounter. Main Street and Budongo Trail aim to provide information as well as engagement, whereas it is reasonable to suggest that the Battle Experience is centred on emotional engagement. The results suggest that by engaging multiple senses in the manner achieved by the Battle Experience, which shuts out extraneous noise from the world outside the exhibit, enables visitors' senses to lock into the exhibit and engage emotionally. This concurs with research by Crigler *et al.* (1994) and Crowest (1999). This dissonance seems to engage and affect visitors, creating a compelling, connecting and immersive experience. Exhibit isolation, the limiting of outside distractions, and multi-sensory characteristics increase salience, thereby increasing visitors' attention (Bechtel and Churchman 2002). This may explain the strong

influence that live animals appear to have on the attention of visitors, which may cause them to engage less with interpretation in the same vicinity.

8.2 Recognising affect

Accreditation in the form of awards for exhibition design is often based on aesthetic qualities and graphic design rather than affect. Yet, these qualities are only one part of an effective exhibition design. For example, Design Museum and the Museums and Heritage Awards recognise function and form, architecture, graphics, customer service, use of budget and entrepreneurship among other categories, but do not reward emotional engagement (Design Museum 2013; Museums + Heritage 2013). The recognition of exhibition design appears to be centred on aesthetics. Museum exhibitions should primarily aim to affect, thereby changing attitudes and forming connections. An exhibit should have more to say than just "look at me" (Rybczynski 2002:4), which may be all visitors do if they are not effectively engaged.

8.3 Reflection on research

Lorentz's (2006) key characteristics of immersive experiences appear to be indicative of the efficacy of an exhibition to engage visitors. Examination of these characteristics can help define an immersive experience and provide indications as to the potential strengths and weaknesses of and exhibition. However, this framework cannot be considered indicative of the affect of an exhibition based on the data from this study as affect appears to be intrinsically individual.

The observational study provided a large amount of quantitative data from which it was possible to establish with reasonable certainty how visitors were using each site, the elements or areas which were attracting the most attention and the most engagement. However, the observational study did not provide data on how visitors were affected by any element of the site, and no data was available on exhibition components which could not always be assessed by Gammon's (2003) indicators, such as aesthetic components (i.e. forest and jungle reconstruction, chimpanzee habitats, vehicles, shop fronts).

The interviews conducted at Culloden yielded lots of rich data and excellent insights into how the exhibit affected visitors. Interviews conducted at Budongo Trail and Main Street were intended to supplement the observational data by providing some insight into visitor behaviour and the efficacy of the exhibit at engaging visitors. These interviews highlighted some fascinating points but were not in-depth enough to provide as rich data as the Culloden interviews. The sample size for the Main Street and Budongo Trail interviews was also not as large as at Culloden, so the points highlighted in these data may not be representative of the population. In future research, a greater number of more in-depth interviews would provide more detailed data on attitudes and emotions.

This research has highlighted that while aesthetics can provide impressive and atmospheric environments it is multi-sensory engagement which appears to affect visitors. Exhibitions which involve multi-sensory engagement for information delivery as well as emotional engagement may be more successful at connecting with visitors. Aesthetics, authenticity and interaction all appear to be key components in creating an effective multi-sensory exhibition and the key may lie in finding balance between these elements, which will depend largely on the aims of the exhibition. While the goal of interpretation should not be to sensationalise issues (Uzzell and Ballantyne 1998:11), dissonance is effective at creating emotional responses, which is key to changing attitudes and forming connections.

This study has shown that immersive experiences cannot be effective if they do not succeed in engaging visitors emotionally. Exhibition planners and designers should give consideration to the use of multi-sensory interpretative media as a tool for generating greater engagement. Consideration should also be given to constructivist learning theory which regards the learning process as a discourse, within which interaction plays a key role. Narrative and the use of virtual characters has been shown to be an effective method of stimulating interaction and engagement through multi-media.

8.4 Dissemination

The findings of this study will be submitted to the institutions in the case studies in order to assist them in their future developments in acknowledgement of their support and assistance. The findings may also be submitted to institutions with dynamic exhibition programmes (i.e. featuring frequent exhibition changes) such as the National Museum of Scotland, Kelvingrove Museum, The McManus Galleries and the V&A. The findings may also be submitted to larger organisations with multiple properties and venues such as Historic Scotland, NTS and National Museums Scotland. This study could also be published online as a free reference material for anyone interested in the subject matter. CIS may also use this research as future teaching material for the Interpretation: Management and Practice MSc course, with a view to introduce subjects of potential future research.

This study may be submitted by the Centre for Interpretation Studies for publication in a peer reviewed journal or other academic publication. Publications might include *The Journal of Interpretation Research, Curator: The Museum Journal,* and *The Journal of Museum Education* with the aim of publicising these findings among the professional community. This may also highlight areas of potential development and stimulate future research. Furthermore, an article may be submitted to publications such as *Interpret Scotland* and to the Association of Heritage Interpretation for their publications in order to generate interest in the subject in readers who may not read peer reviewed journals. The findings of this study may subsequently be presented at a specialist conference, such as the Museums Association Conference.

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