Evaluating Inclusive Design within a Zoological Street Furniture Framework

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Table of Contents

All of the case study photographs are included on a DVD, which is inserted on the inside face of the thesis back cover.

List of Tables

List of Figures

All photography and diagrams are by the author, unless stated otherwise.

Acknowledgements

Declaration

This thesis includes excerpts and concepts from the following publications by the author:

Richards, M.D.W. (2014). Animal-Themed Street Furniture. *International Zoo News, 61*(1), 21-26

Richards, M.D.W. (2014). Designing Accessible 'Do Not Feed' Signs for Zoological Gardens. *International Zoo News, 61*(4), 284-291

Richards, M.D.W. (2014). Enclosure Signage Habitat Range Maps for Zoological Gardens: An Inclusive Design Approach. *Zoo's Print, 29*(4), 15-18

Richards, M.D.W. (2014). The Accessibility of Street Furniture at Chester Zoo: An Interview with Professor Geoff Hosey. *Access by Design, 141*(4), 20-27

Richards, M.D.W. and Ormerod, M. (2015). Directional Zoological Signage Image Preferences: An Inclusive Design Perspective. 12th International Post-Graduate Research Conference 2015: Proceedings. Salford, 10-12 June. Salford: University of Salford. 80-93

Abstract

Inclusive design caters for the needs and aspirations of as many end users as possible, regardless of their age or ability, positively influencing product design and the built environment, and thus society as a whole. By conducting an inclusive design analysis, with reference to zoological street furniture, thesis content evaluates its effectiveness as an analytical tool, contributing to a heightened understanding of the topic to assist older and disabled people. With zoological gardens functioning as a societal microcosm, findings hold broad implications relating to the application of inclusivity ideals outside of a zoology framework.

Research has been underpinned by a constructivist epistemology and interpretivist theoretical perspective. Case study research has been employed as the thesis research methodology, incorporating photography, interviews, and experiments, as convergent research methods. Photography has been used to document zoological street furniture, interviews have provided insights from subject experts, and experiments have gathered feedback from zoological garden visitors. Data collection took place at the Welsh Mountain Zoo, Chester Zoo, Edinburgh Zoo, and Belfast Zoo.

Findings have shown that when general guidance for accessible street furniture provision is applied to zoological street furniture, nuanced environmental factors influence the relevance and assertion of inclusive design. This suggests that each inclusive design analysis is context dependant and that contextually aware reinterpretation of access guidance is required to form effective and accessible design solutions. Thesis content explains the unique nature of zoological street furniture accessibility in the United Kingdom to underline this intellectual position.

Dedication

This thesis is dedicated to my wife Katie.

To be in her presence is to be touched by heaven.

Chapter 1
Research Overview

This introductory chapter details the underpinning personal motivations for the thesis research output. Inclusive design, zoological gardens, and street furniture are discussed sequentially, in terms of these motivations, with the importance of each topic being explained. The thesis aim, objectives, and hypotheses are then established. In addition, a short summary of each of the forthcoming chapters is provided, to enhance overall clarity.

1.1 Research Motivation

'Inclusive design means designing products, services and environments that as many people as possible can use, regardless of age or ability' (Burton and Mitchell, 2006: 5). The author is motivated to conduct inclusive design research partly due to direct personal experiences. These range from product use difficulties, such as not being able to open food packaging, to negative experiences engaging with the built environment, such as wayfinding problems attributed to a lack of lucid signage. It is also acknowledged that as the author experiences accessibility issues, most older and disabled people will encounter far more profound difficulties. Therefore, the author is driven to conduct research, which will be of assistance to those whom can benefit from its results. Concerning inclusive design, personal motivation can be attributed to, and summarised as, a belief in the concept and a desire to help others. Inclusive design has a moral appeal, which relates to an obligation to the whole population, rather than to a single individual or small group (Keates and Clarkson, 2004). It promotes unity and influences virtuous social progress, social sustainability, and civic responsibility (Nussbaumer, 2012).

In terms of personal impetus, it is also believed that inclusive design can mitigate unnecessary exclusion and the feeling that design is discriminatory. Importantly it can eliminate instances where someone eschews social participation because of the built environment, due to a lack of accessible toilet facilities, for example (Bichard, Hanson,

and Greed, 2006). A desire to eliminate isolating and upsetting feelings and instances is a personal, yet clearly understandable, rationale for aligning one's self with inclusive design philosophy. Thesis content is a response to the frustration felt when witnessing exclusionary design, as opposed to a passive acceptance. Inclusive design is positive; hence, a greater understanding of its effectiveness as an analytical tool is also positive.

A study of the influence of context is central to this thesis, thus it was crucial that the author was personally motivated by the research context in which inclusive design ideals were applied and tested. Zoological gardens offer diverse societal benefits, relating to education, conservation, research, and visitor entertainment (Packer and Ballantyne, 2010). The author believes in the value of all the aforementioned benefits; however, the importance of increasing accessibility in terms of education is of particular personal interest. The argument that as many zoological garden visitors as possible should have equal access to on-site educational experiences is central to the research motivation. Another related issue is that explaining, and subsequently understanding, how inclusive design can be achieved within zoological gardens influences a large and diverse visitor demographic (Taylor, 2010), further illustrating the importance of the thesis output.

Concerning personal research motivations, it is appropriate to discuss the unit of analysis. The term street furniture refers to *'items located in street and other pedestrian environments such as lamp posts, litter bins, signs, benches, and post boxes' (Centre for Excellence in Universal Design, 2013: 9).* In many cases, people with reduced capability own products that make their lives easier, for example, people living with arthritis may own an electric tin opener; purchased specifically for this reason. Normally people do not own street furniture, especially with reference to visiting a tourist attraction. Due to this, it is extremely important that street furniture caters to the widest possible demographic, as older and disabled people must use what is *in situ*. Inclusive design finds its home fittingly in the public domain, where end user needs and aspirations constantly vary. Furthermore, inclusive street furniture is often ignored in built environment research terms, in favour of a focus upon city planning, architecture, and landscape design (Siu and Wong, 2015). This lack of attention is unjustified, given that the provision of well-designed street furniture increases accessibility, comfort, and social interactions for people of all ages (Broto, 2012). It is also easier to replace or

refurbish street furniture than conducting large-scale urban redevelopment (Burton and Mitchell, 2006).

1.2 Aim

To evaluate the effectiveness of inclusive design as an analytical tool and to explain the unique nature of zoological street furniture accessibility in the United Kingdom

Although presented as a single statement of intent, the research aim consists of two distinct yet symbiotic elements. The first is focused upon the concept of how conducting research on zoological street furniture accessibility can inform and develop inclusive design as an analytical tool, by exploring its capacity in this role. Zoological gardens function as a societal microcosm, from which it is possible to learn about inclusive design in broader terms, while still retaining a focus upon the specificity of the research aim. The inherent nature of the aim implies that there is value in its focus. Evidence regarding functionality and challenges will inform future use of inclusive design, as a contextually aware and impactful analytical tool.

The second element of the research aim relates to an explanation of domain-specific issues. These are topics unique to the pursuit of street furniture accessibility for zoological gardens. The aim itself proposes that there is value in tailored information, in that it can cease the use of out of context accessibility guidance in what is an undeniably nuanced location set. What makes zoological street furniture accessibility unique is explained through the thesis output.

Research focus is placed solely upon the accessibility of outdoor street furniture, to ensure clarity regarding the unit of analysis. Therefore, other important and related inclusive design topics, such as accessible staircases and ramps, are not discussed in any detail within this thesis. The context of the study is also intentionally limited; this is done to instil clarity and coherence. Zoological gardens provide a neatly bound research framework, allowing for controlled data collection and analysis, and focused arguments to be subsequently constructed. Only items of street furniture found in this location set

have been analysed in relation to the research aim. Nonetheless, relevant installations from other locations are used to illustrate key points, as and when appropriate to do so.

1.3 Objectives

Listed here are the research objectives:

- Document and audit street furniture in United Kingdom zoological gardens

- Categorise street furniture by type and establish which items are typically found in any outdoor location and which are domain-specific

- Analyse the empirical data collected using inclusive design literature and self-observation, in order to review the analytical process and explain domain-specific access concerns

- Review and validate the research findings with subject experts

- Provide a critical synthesis of both the effective outcomes and the challenges encountered when using inclusive design as an analytical tool.

1.4 Hypotheses

While establishing the thesis aim and objectives a number of hypotheses were formulated. All of which serve to further justify the research aim, beyond its own inherent value. Despite its typically successful implementation, conducting an inclusive design analysis is challenging, as it must take into account a wide range of user needs (Goodman-Deane, Ward, Hosking, and Clarkson, 2014). For instance, changes in floor textures are normally beneficial for people with a vision impairment, yet they can impede wheelchair users (Newell, Gregor, Morgan, Pullin, and Macaulay, 2011). Moreover, even within groups of people whom are often considered to share commonalities, such as people living with multiple sclerosis, each individual will have their own subjective preferences and varying levels of capability (Dong and Vanns,

2009). Based upon these documented issues, the first hypothesis was that conducting an inclusive design analysis would be difficult within a zoological context. With this mind it was hoped that doing so would reveal both its functionality and a number of associated challenges, which could be used to inform future practice and thinking on the topic.

The second original hypothesis was that zoological street furniture is not fully accessible. This was an important supposition as had inclusive design already been a prominent consideration in terms of existing zoological street furniture in the United Kingdom, the significance and impact of this thesis would have been lessened. Due to a lack of direct references, this hypothesis was based upon findings from other contexts. Research conducted by Newton, Ormerod, Burton, Mitchell, and Ward-Thompson (2010) highlighted a number of access issues faced by older people in typical high street environments; for instance, people taking part criticised small text sizes on signs and suggested that a confusing amount of information is often presented on maps. The aforementioned hypothesis was put forward, as there was no evidence to suggest that street furniture problems of this nature would not also be prominent within zoological gardens. In addition, Siu and Wong (2015) argue that street furniture is inherently difficult to modify once it has been installed, therefore many designs fail to meet user needs, which have been shaped by temporal and contextual developments. Siu (2008) provides a case in point, stating that when street furniture is imported from one country to another it can fail to meet cultural needs and aspirations. This is similar to the argument that a bespoke approach is required when installing zoological street furniture, due to the nuanced nature of its intended environmental framework.

The third hypothesis was that domain-specific access issues would exist due to the presence of captive animals; as a result, it would be possible to form contextualised explanations. Prior to data collection, personal experience had highlighted the unique nature of zoological street furniture. For example, the author had observed exhibit labels, which provided information on diets, natural habitats, and behaviours, while visiting various zoological gardens (see figure 1.1 for an example from Dudley Zoo). Initial observations such as this highlighted the difference between street furniture in a typical high street and that found in a zoological garden. If the street furniture in zoological gardens was different, it was logical to suggest that related inclusive design issues would also be altered by this context. Rose (2015) presents a comparable statement, noting that swimming pool signage needs to be designed to withstand aggressive atmospheric conditions. This point highlights how the design of street furniture can be heavily influenced by institutional factors. For swimming pools, chemical use dictates signage material, while for zoological gardens, the presence of captive animals and the fundamental nature of these organisations, determines signage content.

Figure 1.1: Red panda (Ailurus fulgens) exhibit label

1.5 Chapter Summaries

This section provides a synopsis of each of the forthcoming chapters:

Chapter 2

Literature Review: Inclusive Design and Zoological Gardens

This chapter presents extensive detail on inclusive design and zoological gardens, explaining relevant terminology, principles, and practice. Key academic arguments are presented to justify the research focus by discussing the value of each topic. Attention is also given to authors whom question the effectiveness of inclusive design, to convey a holistic appraisal, in relation to the thesis research aim.

Chapter 3

Literature Review: Street Furniture

Access guidance for street furniture provision, for instance British Standard 8300, is the primary focus of the second literature review chapter. Current guidance and knowledge collectively demonstrates social benefits, such as increased independent living and community engagement, for older people. Comparable research on zoological street furniture is discussed as well, to highlight an important knowledge gap and to situate the thesis output.

Chapter 4

Research Approach

Epistemology and theoretical perspective are first established within this chapter, prior to an in-depth explanation of the case study research methodology and supporting research methods used for this thesis. Photography, interviews, and experiments are the methods in question. Chapter content explains how and why each method was utilised to present convergent evidence concerning the thesis research aim.

Chapter 5

Effective Inclusive Design

Case study findings are presented from two opposing intellectual positions. Arguments are compartmentalised using both street furniture categories and existing design

guidance. This approach is based upon Dunleavy's (2003) argumentative plus analytic organisational structure, adapted for this thesis, as shown in figure 1.2. For this chapter, evidence illustrates the successful use of inclusive design as an analytical tool, despite the presence of domain-specific concerns. This represents the idea of inclusive design as an uncontested ideal. The chapter shows how best practice design guidance for accessible street furniture can be applied directly to a zoological context, increasing accessibility for end users of all ages and abilities.
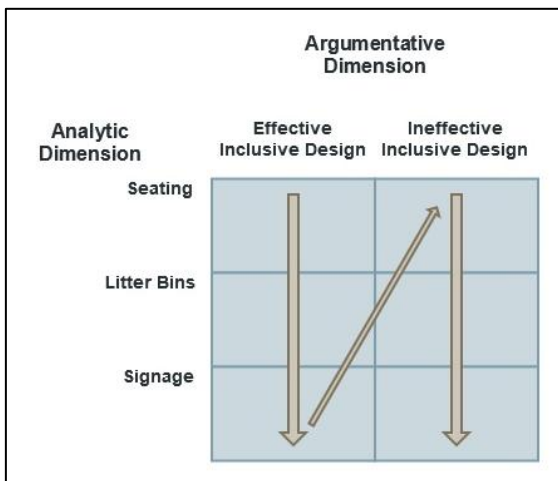
Figure 1.2: Argumentative plus analytic organisational structure

Chapter 6

Ineffective Inclusive Design

The argumentative focus is shifted in the penultimate thesis chapter to challenge existing inclusive design ideals. Case study findings explain why an inclusive design analysis is less effective when domain-specific concerns are taken into consideration, presenting an alternative interpretation and intellectual position. This is aligned with the argument that accessibility guidance is not deterministic, rather it should be reinterpreted when it is applied to a new setting (D'souza, 2004). Photographic data, interviewee feedback, and experiment results are all utilised to present a substantive argument. Conflicts of interest are detailed, showing how supposedly universal accessibility guidance is incompatible with the zoology domain. This in turn suggests that some standard inclusivity principles may also be incompatible with other nuanced location sets. The accumulated data shows that context specific issues should be taken into consideration when the ambition is to provide accessible street furniture for United Kingdom zoological gardens.

Chapter 7

Conclusion

The final thesis chapter concludes in favour of a contextually aware approach to the use of inclusive design as an analytical tool, due to zoological nuances. This conclusion not only informs inclusive design practice in a broad sense, but it also highlights and explains the unique nature of zoological street furniture accessibility, addressing both components of the thesis aim and making a dual contribution to knowledge. Chapter content details the potential impact of this knowledge contribution. In closing, a section is dedicated to discussing current research limitations and a series of future research opportunities.

Chapter 2

Literature Review: Inclusive Design and Zoological Gardens

Inclusive design is the initial focus of this first literature review chapter. Following an introduction to the topic, which establishes the key terms and principles, arguments for the uptake of inclusive design are put forward. The ethical and business cases are presented and supported by significant demographic data, to present a holistic and compelling case. Having established a strong rationale, a range of inclusive design tools and resources are detailed to illustrate the link between theory and design practice. Opposing ideas, which begin to question underlying inclusive design principles and its effectiveness as an analytical tool, are also discussed, in relation to the thesis research aim.

Zoological gardens, the context in which the research is situated, are the secondary focus of this chapter. A conventional literature review on this topic would detail many animal husbandry issues, as well as particulars on conservation initiatives and both ex-situ and in-situ research projects; yet references to such concerns are limited due to the topical focus of this thesis. Instead, literature is discussed from a social value and visitor demographic perspective, linking the zoological context to inclusive design. An argument is put forward emphasising the value of zoological gardens, and in turn, the value of inclusive design within a zoological context. In unison, the inherent significance of both topics is enhanced.

2.1 Inclusive Design

Establishing a definition for inclusive design is essential to be able to evaluate its effectiveness as an analytical tool. Inclusive design is defined as *'a way of designing products and environments so they are usable and appealing to everyone regardless of age, ability or circumstance by working with users to remove barriers in the social, technical, political and economic processes underpinning building and design'* *(Ormerod, Moore, Thomas, Morrow, and Newton, 2002: 1)*. Hence, it encourages

designing for low capability levels (Clarkson, 2009). Redressing the needs and aspirations of typically marginalised groups, such as older and disabled people, and a recognition of diversity are both central inclusive design themes (Cassim, Coleman, Clarkson, and Dong, 2007). Diversity refers to all physical, sensory, cognitive, and lifestyle differences, at an individual level (Macdonald, 2003) and should take into account gender, religion, ethnicity, and sexual orientation, alongside conventional physical accessibility concerns (Bright and Cook, 2010).

Fundamentally, inclusive design is about defining, creating, and evaluating accessible mainstream products and environments, as opposed to developing specialist assistive technology exclusively for disabled people (Næss and Øritsland, 2009). For high levels of impairment, assistive technology or support from a carer is undeniably required (Mellors, 2009); however, inclusive design seeks to increase the number of people who can successfully engage with mainstream products in a dignified manner (Vandenberg, 2008). Doing so can reduce costs for disabled people, as assistive technology is typically very expensive (Clarkson and Coleman, 2015). Inclusive design minimises unnecessary segregation and instances of stigmatising design (Næss and Øritsland, 2009). It forgives user error, offering adaptable, intuitive, and simple solutions, ultimately increasing quality of life (Herwig, 2008). To achieve this goal, it is typically associated with an in-depth understanding of diverse needs and aspirations, informed by ongoing engagement with end users throughout a design process (Ormerod, Newton, Phillips, and Musselwhite, 2015). This is significant, as inaccessible products and environments are regularly attributed to a lack of understanding, regarding older and disabled people (Clarkson, Dong, and Keates, 2003).

A recognition of and a response to the human ageing process is central to inclusive design philosophy. It is a response to the fact that design traditionally caters only for the needs and aspirations of young able-bodied male adults (Burton and Mitchell, 2006). As people age their physical and mental capacity gradually declines (Kose, 2003). Products and environments designed with this in mind help end users at different stages of their life span. Inclusive design also assists those with temporary impairments (Mellors, 2009), recognising further that the human condition is inherently fluid (Imrie, 2004). As all of us age, inclusive design has universal significance.

The term inclusive design is used throughout Europe, whilst the term universal design is used in North America and Japan, to describe comparable social emancipation ideals (Ostroff, 2011). Despite the fact that terminology varies, Ostroff (2011) states that the underlying premise for both inclusive and universal design is consistent on a global scale. However, Imrie (2004) claims universal design is based upon a consumerist perspective of participation, whereas inclusive design relates to a reciprocal relationship between designers and end users, illustrating a key difference. This thesis utilises the term inclusive design, not only due to its European origins and its focus upon understanding end users, but also due to a semantic rationale. When taken literally, universal design implies an unrealistic ideal (Steinfeld and Maisel, 2012), so it can be described as an oxymoron (Preiser, 2009), or a Sisyphean task. User conflicts at an individual level mean it is impossible to design for all needs and aspirations (Imrie, 2004), without resorting to design which is often complex, confusing, and compromised (Pullin, 2009). Inclusive design conversely suggests a more achievable increase in accessibility; a design can be more inclusive than its predecessors, yet far from universally accessible (Nussbaumer, 2012). Adding Braille to a sign, for example, only increases accessibility, without having any impact upon people who do not require its presence. This is not to say that such a sign is entirely accessible, yet it is an improvement upon alternatives designs, which omit Braille. To offer further critique of the term, and in support of this argument, D'souza (2004) proposes that there is a dichotomy between universality and subjective needs. Moreover, a universal approach fails to acknowledge individual distinctiveness (Imrie, 2012) or offer a practical framework for expenditure (Nussbaumer, 2012).

Throughout this thesis, the terms inclusive and accessible are used interchangeably. It is nevertheless acknowledged that accessibility predominantly and traditionally refers to physical barriers and mobility concerns (Ostroff, 2011). In addition, Bringolf (2010) argues that the word accessible can be seen to directly reference disabled people, whereas inclusive design describes social inclusion for all users. While these semantic arguments are recognised, referring to a toilet facility as accessible or inclusive is more appropriate than describing it as a disabled toilet, as doing so reinforces the concept that disabled people are a separate and homogeneous cohort within society, and can stigmatise end users (Greed, 2003). This example is functional, as it describes how

using the term disabled signifies impairment, and so it should be avoided in favour of either inclusive or accessible (Bringolf, 2010).

Detail on language use within this thesis provides a contextually aware frame of reference for research findings. However, Shakespeare (2014) describes an uncomfortable truth, stating that using current or supposedly politically correct terminology does not necessarily suggest enlightened thinking, albeit he acknowledges how words alone can shape social constructions and enforce negative ideas. With potential negative connotations in mind, this thesis primarily uses the terms inclusive and accessible. The phrase 'disabled people' is also used as and when it is required, as a form of people first language (Pullin, 2009). Doing so emphasises the disabling role of society, whereas the pejorative term 'people with disabilities' suggests deficits at the individual level (Shakespeare, 2014). Efforts have been made to utilise appropriate terminology throughout to reflect the author's views on disability, however the focus of this thesis is upon its contribution to knowledge, irrespective of any semantic criticisms.

Inclusive design ideals are closely aligned with the social model of disability (Ormerod, 2005), which functions as a transformative framework in both a practical regard and a theoretical sense. The basic premise of the social model of disability is that disabled people face access issues within the built environment due to the environment itself, as opposed to their own impairment being the cause of accessibility barriers (Darcy and Buhalis, 2011). Thus, access barriers should not be attributed to an individual, only to designs that fail to take their needs into account (Goldsmith, 2011). The opposing medical model suggests that a person's impairment is the primary cause of any problems they encounter when interacting with the built environment (Ostroff, 2011), concurrently implying that disabled people are misfortunate victims whom require care from others to live independently (Imrie and Hall, 2001). A particular failing of the medical model is that it allows property professionals to identify individual impairment as the cause of an access barrier, thus absolving any responsibility on their part (Imrie and Hall, 2001). In opposition, the social model suggests that impairment is a physical dysfunction (Oliver and Barnes, 2012); while disability is a social construct (Goldsmith, 2011). Therefore, accessibility is a wider societal concern and responsibility, which should be addressed by all corners of society (Owens, 2015).

The social model of disability is inherently linked to human rights and equality, functioning as a form of political activism (Owens, 2015). To date, it has improved attitudes towards disabled people and influenced corrective action regarding inaccessible design within the built environment (Oliver, 2013) to increase social participation (Darcy and Buhalis, 2011). However, critics suggest that it fails to consider individual differences, thus it categorises disabled people as a unitary group (Oliver, 2013). Moreover, it fails to consider the relationship between illness and impairment and the varied interpretations of capability loss (Owens, 2015) or if individual impairment is actually debilitating (Imrie and Hall, 2001). A specific criticism is that for high levels of impairment, accessible design and social change cannot hope to counter participation barriers (Crow, 2003).

The social and medical models of disability are habitually presented as opposing and extreme choices. Yet there is an alternative, the bio-social model of disability, which seeks to unify biological and social facets of disability (Imrie and Hall, 2001). This model argues that disability is both a personal and social problem; as a result, it typically requires both personal and social action as a form of response (Zajadacz, 2015). By merging social and medical concepts, the bio-social alternative seeks to highlight the complexity of disability, as opposed to categorising or standardising individual experience (Imrie and Hall, 2001). For this thesis, the value of the social model and the bio-social model are mutually accepted, whereas the medical model is rejected by the author.

2.2 Why Practice Inclusive Design

2.2.1 The Ethical Case

Arguments for the uptake of inclusive design are supported by a persuasive ethical case, suggesting that older and disabled people are excluded by inaccessible products and the built environment, due to factors beyond their own control (Keates and Clarkson, 2004). The influence of exclusion extends far beyond decisions made during a design process, linking directly to social exclusion. Quality of life can be directly affected, if community engagement is curtailed by inaccessible design, resulting in isolation and

loneliness (Manley, 2011). This in turn extends to concerns over both the physical and emotional wellbeing of marginalised groups (Manley, 2011). In relation to these issues, Clarkson (2009) stresses the need to extend independent living for older and disabled people, as a moral imperative. The concept of autonomy relates to dignity (Myerson, 2007), further highlighting the value of inclusive design and the rigour of the ethical case for its uptake.

Inclusive design is not only a minority interest but rather it helps all end users (Manley, 2011), owing to the prevalence of design exclusion (Keates and Clarkson, 2004). Importantly, an increase in accessibility for one user group typically helps others simultaneously, in both a sociological and existential sense (Ryhl, 2009). To illustrate this idea, Knight and Bichard (2011) explain that the increased widths of accessible toilet facilities are essential not only for wheelchair users, but also for people with pushchairs and buggies. Equally, television remote controls are indispensable for people who find walking difficult, yet they are used ubiquitously as a technological convenience for most end users (Keates and Clarkson, 2004). Audio books present a further example. Although originally designed for people with a vision impairment, they are enjoyed by many people who are able to read printed texts without difficulty (Pullin, 2009). The ethical case is therefore supported by existing inaccessible design and the wide-ranging positive impact of inclusive design, for people of all ages and abilities.

An increase in accessibility for older and disabled people has traditionally focused upon end user needs, without taking aspirations into account (Langdon, Johnson, Huppert, and Clarkson, 2015). A design can be physically accessible, but fail completely concerning social acceptability, and this issue plagued earlier attempts to design for, rather than with, disabled people (Macdonald, 2003). In response to this problem, inclusive design represents an ethical and human-centred approach, as it considers social and technical issues as unitary concerns. Rather than employing a solely functional perspective, the user experience, in terms of pleasure, preference, and convenience, is a central consideration (Coleman, 2011).

The aphorism designing for our future selves is used within literature to illustrate the self-interest argument for adopting inclusive design principles (Clarkson and Coleman, 2015). Functioning as a development or subsidiary of the ethical case, the self-interest

argument for inclusivity compels designers to consider access issues they do not currently face, but may well do so in the future (Myerson, 2007). In relation to this concept, Vavik and Gheerawo (2009) point out that all people at some stage in their lives will experience a reduction in functional capability, due to an accident, illness, or ageing. Equally, environmental influences can result in capability loss; being in a dark room affects vision, for example (Story and Mueller, 2011). Inclusive design not only helps all other end users, but also those involved in a design process, albeit they may not benefit directly for an undetermined period of time.

2.2.2 The Business Case

The relationship between inclusive design and increasing profits is central to the business case for its uptake. Accessible products can be used by a greater number of people; therefore, they are more likely to be purchased by a greater number (Keates and Clarkson, 2004). Inclusive design can increase customer satisfaction and brand loyalty, which can in turn increase revenue through repeat business (Coleman, Topalian, Dong, and Clarkson, 2007).These concepts are supported by the fact that disabled and older people have great economic significance (Clarkson and Coleman, 2015). The annual spending power of disabled people in the United Kingdom is worth more than £212 billion, yet firms throughout the United Kingdom lose approximately 1.8 billion each month due to inadequate provision for disabled customers (Business Disability Forum, 2015). Supply and demand reflects an uneven relationship. Hemingway (2011) highlights this issue in relation to accessible housing, describing the lack of availability for disabled people. A central driver for this problem is that the needs and aspirations of disabled people are typically latent and suppressed due to dependence upon external support, which may be disobliging or infrequently available (Imrie and Hall, 2001). For service providers, the myopic claim that disabled people do not use facilities, therefore there is no need for inclusive design is nonsensical, as an accessibility deficit may be the sole reason for their lack of attendance (Imrie and Hall, 2001). Demand for accessible products exists, yet it is poorly addressed and disavowed, reflecting a missed business opportunity.

Inclusive design offers companies an opportunity to maximise untapped potential by adapting to market changes (Eikhaug, 2009). Potential market changes include

demographic shifts, technological developments, and the advent of new legislation (Coleman *et al*, 2007). Europe's ageing population represents a significant demographic shift related directly to accessibility (Clarkson and Coleman, 2015), as does the increased incidence of dementia (Langdon *et al*, 2015). Literature states that by 2050 the number of people worldwide who are over 60 years of age will have doubled compared to recorded numbers for 2013 (United Nations, 2013); while the number of people with dementia will have more than doubled by 2050 (Freegard, Pond, and Forman, 2015). In light of these predictions, designing products to meet the needs and aspirations of older people makes economic sense. Demographic changes augment the business case for inclusive design regarding market potential and highlight the increased need for design that older people can engage with easily. Herwig (2008) provides a compelling illustration, stating that over eighty percent of luxury cars sold in Germany are purchased by people over fifty years of age.

Designing inclusive environments for employees also relates to the business case. An ageing population, and consequently an ageing workforce, is a global phenomenon (Myerson, Bichard, and Erlich, 2010). Companies therefore need to design workplaces, which take into account the universal effects of ageing, such as a loss of dexterity (Myerson *et al*, 2010). By 2027, the average retirement age in the United Kingdom will have increased from 65 to 67, with added fiscal payments for those delaying retirement until age 70 (Wheaton and Crimmins, 2013). Relatedly, Myerson *et al* (2010) argue that demographic trends, and their impact upon workplace design, can be far more accurately predicted than technological or economic alternatives. Inclusive design benefits both employers and employees, as an inaccessible workplace affects both satisfaction and productivity for older and disabled people (Sanford, 2012), eventually undermining profits (Nussbaumer, 2012). As noted by Keates and Clarkson (2004), an accessible working environment can reduce the need for pension payments, attributed to medical retirement, and cut unemployment benefit claims (Hurstfield, Parashar, and Schofield, 2007), further strengthening the business case.

The business case for inclusive design is supported by an economic rationale, regarding the significant cost saving advantages normally associated with independent living for older people (Christophersen, 2009). Inclusive design can address a lack of care home availability and public resource by allowing people to stay in their own homes for as

long as possible (Burton and Mitchell, 2006). In the United Kingdom, this results in savings for the Exchequer, due to reduced reliance upon government health services (Hurstfield *et al*, 2007). In light of a diminishing support ratio, these issues are of great pertinence. A support ratio is defined as *'the number of people aged 15 to 64 who could support one person over 65 years of age' (Waller and Clarkson, 2009: 1)*. The European support ratio was 3.5 during 2010 (Organisation for Economic Co-operation and Development*,* 2011). However, it is predicted to drop to 1.8 by 2050 (Organisation for Economic Co-operation and Development, 2011). This data further advocates the uptake of inclusive design. It emphasises the need for design that aids independence and autonomous use, specifically for older people, within what will normally be a fiscal context.

Pertaining mostly to large organisations, inclusive design can be linked to achieving a desired level of corporate social responsibility (Hussain, Ahmad, and Case, 2015), which occurs when business practice reflects a responsibility to mutually maximise profits and benefit society (Chandler and Werther, 2014). Placing inclusive design in this framework means that accessible products can be profitable as they serve a large and growing market share, yet they can also enhance quality of life by enabling dignified and autonomous use. When used as a strategic business tool, corporate social responsibility can enhance public perception through ethical practice (Eikhaug, 2009). It creates a public feeling that an organisation cares about the wider community, often resulting in a competitive advantage (Aragall and Montana, 2012).

A legal argument supports the business case for inclusive design. Major United Kingdom legislative developments in favour of increasing accessibility for disabled people include the Disability Discrimination Act (1995) and the Equality Act (2010) (Clarkson and Coleman, 2015). Most recently and in sum, the Equality Act (2010) seeks to tackle discrimination against disabled people by public service providers (Government Equalities Office, 2010). Although specifics are subject to change when new legislation is developed, companies that fail to comply with legal requirements can be exposed to discrimination claims, resulting in high costs and damaged public reputations (Keates and Clarkson, 2004). To increase earning potential, companies should look to design with international legislation in mind, thus allowing products to be marketed globally (Mellors, 2009). Therefore, wider legislative compliance allows

for expansion into untapped markets. In all cases, an inclusive design approach, which goes beyond legal requirements, is advised to avoid punitive measures (Casserley and Ormerod, 2003).

As a final adjunct, Coleman, Bendixen, and Tahkokallio (2003) offer an additional rationale for designing inclusively to increase profits. They state that companies who develop a methodology to design for the wider population can apply identical techniques to numerous different product types, saving time and money. For instance, once a company has an understanding of how to consider the needs of people living with limited dexterity when designing cutlery, they can apply some of this knowledge to designing other products, such as crockery. After inclusive design is understood, there is no need to relearn its fundamental characteristics.

Despite the value of existing arguments in its favour, a number of barriers are generally associated with the business case, including a perceived lack of resources, guidance, and government regulations (Hussain *et al*, 2015). Companies often have to make funds available to adapt business models, retrain staff, and assimilate a new knowledge base, to adopt an inclusive design methodology (Coleman *et al*, 2007); hence, there is a general perception that inclusive design is expensive to implement (Cassim and Dong, 2007). For property professionals these concerns are augmented by the view that accessible features add no value to a property and can actually undermine resale values (Imrie and Hall, 2001). However, as detailed in this section, initial expenditure can ultimately result in increased brand loyalty and customer satisfaction, in conjunction with increased revenue, via previously untapped markets. In reality, the application of inclusive design usually results in increases in accessibility for very negligible extra costs (Christophersen, 2009). Property developer Landcom (2008), for instance, found that even when accessibility was considered as an afterthought it only increased the cost of a new build residential property by up to two percent. Inclusive design is not expensive; it does however allow organisations to evidence corporate social responsibility, further illustrating the worth of the business case.

2.3 Tools and Resources

Inclusive design should be considered at the outset of any design project (Ormerod and Newton, 2005), to ensure holistic integration and to reduce costs associated with retrofitting (Wentz, Jaeger, and Lazar, 2011). Literature documents a number of tools and resources, which allow designers to realise inclusive design ideals and understand accessibility concerns at the early stages of the design process. This section looks at the advantages and disadvantages of several approaches towards conducting an inclusive design analysis. Reviewing numerous techniques provides an explanation of how inclusive design theory can be applied in a practical regard, influencing the lives of real end users of all ages and abilities. In terms of formal assessment, evaluating inclusivity involves either means to engage with end users, such as direct observation, or techniques that do not evidence direct user participation, such as simulation (Dong, Nicolle, Brown, and Clarkson, 2007). In all cases, convergence is recommended, to exploit the distinct advantages of each individual approach (Goodman, Langdon, and Clarkson, 2007).

There is a strong case for user involvement when practicing inclusive design; *'only someone who has personally experienced disability can fully understand the challenges of living with a disability in a world designed for the most part as if such persons did not exist' (Story and Mueller, 2011: 1).* Even when accessibility is taken into consideration, designers can fail to appreciate product use difficulties faced by older and disabled people, especially with reference to multiple impairments; hence, feedback from real people is required (Langdon *et al*, 2015). A lack of available data concerning the impact and prevalence of functional impairment adds to the case for end user engagement, to understand design exclusion (Langdon *et al*, 2015). User trials involving both disabled and non-disabled users are therefore advocated by Clarkson, Cardoso, and Hosking (2007), to provide varied personal usability insights, and to engender empathy amongst designers, highlighting issues such as dignity and autonomy. This process involves people testing a product, usually within a controlled environment and by performing set tasks (Yelding and Cassim, 2007). In relation to the social model of disability, user trails should assess product accessibility, not the personal capability of those involved in testing (Antona, Ntoa, Adami, and Stephanidis, 2009). A focus upon

comfortable limits of functionality, as opposed to maximum capability, is recommended as being more fitting from an inclusive design standpoint (Langdon *et al*, 2015). Benefits aside, engaging with real people is typically time consuming and can be expensive (Cardoso and Clarkson, 2007). For product development in particular, it can postpone time to market, delaying a return on investment for shareholders (Keates and Clarkson, 2004). An alternative perspective and one in favour of user trials, is that detailed testing during product development can ultimately result in increased customer satisfaction, and sales, once a product is released (Clarkson *et al,* 2007).

Direct observation can be employed as an alternative form of end user engagement, allowing designers to asses product use in a real world setting, such as the home environment (Cardoso, Keates, and Clarkson, 2004). Doing so typically facilitates a comprehensive understanding of the relationship between access issues and contextualised individual behaviour (Waller and Clarkson, 2009), especially regarding evidence of coping mechanisms for older and disabled people (Yelding and Cassim, 2007). People are more likely to behave naturally in a familiar environment, yet their behaviour is also likely to alter if they are aware of observation taking place (Cardoso *et al*, 2004). Undertaking direct observation presents a number of ethical concerns, as it can invade privacy and draw unwanted attention towards impairment (Antona *et al*, 2009). It does however present an opportunity to gather data typically missing in the results of major disability surveys, such as feedback from people living in care homes or from those with peripatetic lifestyles (Langdon *et al*, 2015). Furthermore, it allows for an objective appraisal of performance. This is significant, as older and disabled people can prejudge how impairment influences performance, as they may compare their own capability to that of their peers, or to previous levels of functionality (Langdon *et al*, 2015).

End user feedback can also be gathered remotely via cultural probes, using activity dairies, for example (Lebbon, Rouncefield, and Viller, 2003). These are completed by participants who document access issues they face on a daily basis (Antona *et al*, 2009). A key advantage of utilising this technique is it allows for feedback about the social context in which products are used over an extended period of time (Antona *et al*, 2009). Research undertaken by Ward Thompson, Curl, Aspinall, Alves, and Zuin (2012) has shown that diary entries help to explain why something occurred, rather than

simply recording incidence rates. Despite this inherent advantage, record completion itself may cause access concerns for people who find it difficult to articulate their needs and aspirations, presenting an unwelcome paradox (Waller and Clarkson, 2009).

The call for user participation in the design process extends to those with related knowledge of the needs and aspirations of older and disabled people. Occupational therapists and nursing staff can both offer valuable insights concerning accessibility (Nussbaumer, 2012). With specific reference to academic endeavours, collaboration between built environment researchers and gerontologists can enhance an inclusive design research process, by means of relevant knowledge transfer (Nussbaumer, 2012).

In lieu of feedback from real end users, impairment simulators can be used in an attempt to reproduce various forms of motor and sensory, but not cognitive, capability loss (Waller and Clarkson, 2009). Wearing simulators allows people to assess products and environments from a disabled or older person's perspective, often contributing new empathetic insights (Herwig, 2008). The use of user trials to inform simulator development typically enhances reliability and credibility, allowing designers to reproduce impairment, albeit in a partial form (Biswas, Robinson, and Langdon, 2012). While simulators can be purchased, Clarkson *et al* (2007) provide a cost saving rationale for this approach, suggesting that smearing glasses with grease can simulate visual impairment, for instance. Making a comparable point, Story and Mueller (2011) propose reading an instruction manual in a foreign language or attempting to zip a jacket up with one hand, to begin to appreciate access issues faced by other people. Despite simulators offering a quick and potentially low cost practice, they do not replicate pain (Goodman-Deane, Waller, Collins, and Clarkson, 2013) or take individual coping strategies into account which may reduce levels of exclusion and capability demands (Bradley, Langdon, and Clarkson, 2011). A final, but nonetheless significant failing, is that impairment simulators do not reflect the personal characteristics of individual people, such as expertise or levels of interest (Biswas *et al*, 2012).

Exclusion calculators can also be used to help designers consider the needs of older and disabled people, without direct user participation. The Inclusive Design Toolkit, produced by the University of Cambridge Engineering Design Centre (2015), offers an online exclusion calculator, which allows users to determine what percentage of the

population will theoretically be excluded by specific design decisions. It shows that should a design require people to be able to read typical print sizes in a newspaper, this would exclude approximately 3.5% of the adults in Great Britain. The example used does not take any other issues into account; however, the calculator can function cumulatively. It shows that if end users are required to read typical newspaper print and bend down to their knees, then the overall exclusion rises to 9.4%. Exclusion calculators systemically and simultaneously represent the needs of a large number of end users (Goodman-Deane, Waller, Williams, Langdon, and Clarkson, 2011). Yet, they have inherent limitations. One such limitation is described by Goodman-Deane *et al* (2011) who state that in the case of the Inclusive Design Toolkit, the exclusion calculator cannot evaluate separate dexterity demands, when a users left and right hands undertake distinct tasks.

Designers can refer to inclusive design guidance documents to understand, address, and identify with accessibility concerns (Clarkson *et al*, 2007). The Centre for Excellence in Universal Design, for instance, has produced a number of publications outlining best practice design guidance for older and disabled people. Accessible parking spaces present a case in point, with guidance suggesting the inclusion of 1200mm safety zones on either side of parking spaces to ensure access for wheelchair users (Centre for Excellence in Universal Design, 2013). The value of guidance documents should not be underestimated, as they can represent access issues faced by a diverse range of individuals in an objective and functional format (Christophersen, 2009). Utilising inclusive design literature represents a quick and low cost approach, as it can be undertaken independently. Nevertheless, designers have criticised the overly prescriptive nature of guidance documents and the inaccessible writing style of academic papers on the subject of inclusive design, whilst stating that relevant guidance is often difficult to find (Goodman *et al*, 2007) and typically lacks reference to practice (Nussbaumer, 2012). These particular criticisms, more so than for other tools and resources, point towards the need for inclusive design guidance to represent the milieu in which it is situated, for it to be fully embraced by those whom share its frame of reference.

Personas, detailing the needs and aspirations of fictitious individuals, are a further example of a tool typically utilised by inclusive designers to identify with older and

disabled people, when not interacting directly with real end users (Dong *et al*, 2007). They are used to generate empathy and provide insights depicting the lives of a diverse range of people, usually using both imagery and text (Goodman *et al*, 2007). Personas are normally based upon initial feedback from multiple end users, which is subsequently used to create data sets reflecting an amalgamation and summary of user characteristics (Bichard *et al*, 2006). A key advantage of personas is they allow for complete anonymity for people providing initial feedback (Bichard *et al*, 2006). Nonetheless, the creation of representative personas for a specific design project is normally a very lengthy process (Goodman *et al*, 2007), and often fails to provide technical detail concerning specific capability loss (Antona *et al*, 2009).

Self-observation is the final inclusive design resource, not involving direct contact with end users, to be discussed in this section. The process involves a single individual accessing access issues, by taking user diversity into consideration (Cardoso *et al*, 2004). Doing so presents relatively low time and budget constraints (Keates and Clarkson, 2004). It is also an especially useful approach concerning people who cannot articulate access issues themselves (Adams and Langdon, 2004) and avoids requests that cannot feasibly be accommodated (Pullin, 2009). However, overly subjective interpretations may fail to take the needs and aspirations of others into account (Keates and Clarkson, 2004), whilst being somewhat anecdotal (Preiser, 2011). These shortcomings are less of a concern if the practitioner has a comprehensive knowledge regarding diverse user capabilities (Cardoso *et al*, 2004).

The concept of self-observation is comparable to conducting an access audit. Vandenberg (2008) states that access audits examine existing buildings or environments, to make recommendations on how to improve accessibility for older and disabled people. A typical visitor journey sequence should be followed when undertaking an access audit, highlighting physical, cognitive, and sensory access concerns (Ormerod, 2005). Both positive and negative features should be noted while conducting an access audit, to propose potential improvements and commend existing good practice (Ormerod, 2005); highlighting the presence of colour contrast bands on bollards, which enhance visibility (Hersh and Johnson, 2008), for example (see figure 2.1 from the University of Chester). The final phase of an access audit is compiling a report, stating which access concerns to prioritise and why (Sawyer and Bright, 2014).

Figure 2.1: Bollards

A variety of evaluation tools and resources can be utilised by inclusive design practitioners. Most effective is to draw on the advantages associated with multiple techniques, thus countering the shortcomings on any one approach, all of which seek to develop an understanding of and address access barriers. Arguments for and against different approaches relate primarily to cost and time issues, meaning that the use of particular techniques will be mostly determined by financial restraints. This detail should not be overlooked, especially for self-funded and part-time research projects. Ethical concerns must be taken into account as well, determined largely by the nature of the design project being undertaken and the specifics of capability loss. Principally for this thesis, guidance documents and self-observation have been utilised, while a number of other techniques have been used to a lesser extent. Chapter 3 presents information from existing guidance documents for the design of accessible street furniture, while

Chapter 4 explains the thesis research approach, covering self-observation in more detail.

2.4 Challenges

Factors influencing the effectiveness of inclusive design as an analytical tool are the focus of this section. Established challenges point towards the need for further evaluation and questioning of current orthodoxy. Existing arguments highlight the influence of context upon the relevance of inclusive design guidance, including a review of environmental, geographic, and cultural factors. In terms of the built environment, best practice guidance must fit its context of application; therefore, it cannot be simply transferred from one environmental framework to another (Barrett and Barrett, 2003). In a broad sense and within most literature, inclusive design is presented as an incontestable ideal, but depending upon its context of application its relevance and assertion is subject to varying degrees of external pressure. The challenges discussed here influence the effectiveness of inclusive design, which subsequently affects the lives of older and disabled people.

Elton and Nicolle (2010) propound the argument that current inclusive design tools and resources typically lack an awareness of the influence of context. By context, they do not refer to a specific type of location, but rather variable external influences. They cite changes in lighting levels and weather as key examples, which reduce functional capability for all users; a product may be considered to be inclusive within a design studio or even in a home setting, yet it may be rendered useless by inclement weather. When the item in question is designed primarily for outdoor use, this is a significant concern. Their argument is predicated on the notion that context directly impacts physical capability and does so on a regular basis as social environments are rarely optimised for specific product use. For example, cold weather may result in a loss of dexterity, or a high pollen count may cause an allergic reaction (Vavik and Gheerawo, 2009). The argument that varying external factors can alter the validity of existing access guidance is a relevant challenge regarding the effectiveness of inclusive design as an analytical tool. This specific challenge contributes towards a broader argument

that inclusive design is context dependant, thus guidance documents should reflect this fact.

The notion that geographical context and cultural variation influence the applicability of inclusive design guidance is put forward by Herwig (2008). Although there is a universal desire for needs and aspirations to be met, what these are is subject to global disparity. In terms of design, social acceptability is highly influenced by local culture (Herwig, 2008), while the impact of ageing upon both physical and cognitive capability is subject to geographical variation (Biswas and Langdon, 2014), as are most legal access requirements (Casserley and Ormerod, 2003). Despite the fact that some colours convey universal meaning, such as red and blue for hot and cold, others are highly subject to variations in how they are understood, directly affecting their use within the built environment (Gibson, 2009). In an increasingly globalised society, issues like this are further intensified, especially when access priorities vary depending upon cultural norms (Preiser, 2009). This information challenges the idea of appropriating inclusive design ideals from one context to be applied in another.

When considering both needs and aspirations these two elements can come into conflict, depending upon cultural context. Hearing aids are typically designed to be as small as possible, allowing for discretion and concealment (Pullin, 2009); which is important as inclusive design should not draw undue attention towards individual impairment (Nussbaumer, 2012). However, from a technical standpoint, the primary function of hearing aids is compromised by size constraints (Pullin, 2009). Fashion presents a useful illustration of how the assertion of need can be overshadowed by aspiration, thus highlighting the challenging nature of undertaking an inclusive design analysis.

A further tension, between inclusive design and deterring vandalism, is well encapsulated by the following quotation *'how the needs of the many have been overshadowed in the design process by the behaviour of a few' (Knight and Bichard, 2011: 7)*. The point being made refers to the misuse of toilet facilities. The key issue is that steps taken to 'design out crime' can equally act as a barrier to accessibility, albeit an unintentional one (Knight and Bichard, 2011). This is yet another illustration of how contextual factors can disrupt an inclusive design approach.

Inclusive design literature acknowledges that conflicting requirements such as the conservation of heritage and environmental sustainability sometimes overshadow access concerns (Noble and Lord, 2004). On occasion a perceived increase in accessibility may raise fresh health and safety concerns, thus the fear of litigation undermines the realisation of inclusive design (Preiser, 2011). These points question the effectiveness of inclusive design, especially as an uncontested ideal. When contextualised priorities differ, accessibility may be considered secondary or low priority. Sawyer and Bright (2014) play down this challenge, suggesting that access concerns and historic preservation can be reconciled. While this is no doubt accurate, rather than representing a harmonious reconciliation, it could equally be described as a strained compromise. Their argument is based upon the fact that in some buildings only certain features will be listed and in other situations access can be addressed through non-permanent installations, such as temporary ramps. The concept of temporary inclusive design solutions downgrades the needs of disabled people and only serves to illustrate further an inherent tension and contextualised conflicts of interest. In turn, conflicts of this nature challenge the overall effectiveness of inclusive design as an analytical tool.

Further questions have been raised about the scope of universal design, however these points all relate to inclusive design. Specifically, it has been stated that universal design is principally functionalist (D'souza, 2004). As a consequence, it offers only reductive technical solutions (Imrie, 2012). Whilst doing so can increase accessibility, advocating only technical solutions fails to address contextualised socio-political variation (Imrie, 2012). Therefore, it can be seen to propagate irrelevant generalisations in a prescriptive and onerous manner, making inappropriate assumptions about the lives of disabled people (Herwig, 2008). These arguments further illustrate the tense and complex relationship between inclusive design ideals and their context of application, stressing the need for further related academic inquiry. Context has a significant influence upon the value of inclusive design, encompassing a wide range of factors from social norms to religion, which may not be commensurate with an increase in accessibility. Consequently, the next section discusses the specific value of increasing accessibility within zoological gardens. Thesis output explains how the zoological context is highly influential in determining the effectiveness of inclusive design, due to the unique nature of its street furniture. The following section begins to describe what makes zoological

gardens unique in relation to inclusive design, whilst also exploring a distinctive social value and visitor demographic.

2.5 Research Context: Zoological Gardens

In Europe, zoological gardens are the most popular paid visitor attraction (Sheridan, 2013), being visited by more than 140 million people on an annual basis (European Association of Zoos and Aquaria, 2015). In Britain, annual attendance is approximately 25 million (British and Irish Association of Zoos and Aquariums, 2015b). Visitation is socially inclusive and democratic, as zoological gardens appeal to a broad audience, which transcends economic barriers (Regan, 2005). Although all members of society visit zoological gardens, women aged 25-35 attending with young children, are most representative of the typical visitor profile (Rees, 2011). However, due to Europe's ageing population, zoological gardens will need to adapt to changing demographics to attract older people (Rees, 2011), *vis-à-vis* the business case for inclusive design. This point is particularly relevant, as grandparents often play an important childcare role, offering key parental support (Majamaa, 2012). High visitation numbers, the diversity of the visitor profile, and our ageing population all present evidence regarding the potential impact of inclusive design within a zoological context.

Of particular significance is the high number of foreign visitors who attend zoological gardens (Baratay and Hardouin-Fugier, 2003). At London Zoo, people from overseas make up around 13% of the visitor population (Frost, 2011), presenting unique inclusive design challenges primarily associated with language comprehension. Most specifically this issue relates to signage. Inclusive signage, conveying universally understood messages, is important in zoological gardens due to their popularity with foreign tourists. The provision of street furniture, which caters for the needs of foreign tourists, presents an opportunity to create both welcoming and legible environments for all users, evidencing the value of inclusivity in this context. This is essential given that the tourism experience or 'moment' is only facilitated once communal belonging is established (Hom Cary, 2004). However, there are not only needs but also aspirations to consider when designing sign content, as species popularity is highly subject to cultural variation (Frost and Laing, 2011). In relation to the business case for inclusive design,

responding to the needs and aspirations of a significant percentage of the visitor demographic makes pecuniary sense.

Education, conservation, research, and visitor entertainment are generally considered to be the mainstay roles of modern zoological gardens (Fa, Funk, and O'Connell, 2011). Sheridan (2011) argues that education is the most important role for a progressive zoological garden, as without an awareness of habitat and biodiversity loss and unsustainable human population growth the general public will fail to take action regarding these crucial issues. People visiting zoological gardens benefit from varying forms of biological conservation education, including organised animal encounters, keeper talks, signage, guided tours, and dedicated classes, usually designed for schoolchildren within on-site education centres (Sheridan, 2011). Boksberger, Schuckert, and Robinson (2011) present a further example, suggesting that ethical practice, such as making use of free-range eggs, can convey educational messages. In addition, a demonstration of exemplary animal welfare is informative and influences how visitors care for their own household pets (Fa *et al*, 2011). The educational scope of zoological gardens represents an uneven knowledge base, benefitting primary and secondary school children, higher education students, postgraduate students, and the global academic research community, alongside people seeking related work experience (Regan, 2005); it is inclusive of all forms of education. Educating children is particularly important as it influences society's future decision makers, with reference to essential conservation initiatives (Regan, 2005). It can also be argued that zoological garden visitors are more receptive to conservation messages than those visiting analogues organisations, due to the emotional impact of on-site animal encounters (Smith, Weiler, and Ham, 2011). The scope and value of education within zoological gardens discussed here supports the application of inclusive design ideals in a set of locations with inherent social value. In relation to zoological education, the ethical case for inclusive design shares a mutual relationship with conservation and animal welfare ethics. Studies have shown that people are increasingly likely to absorb educational messages when exhibits convey multisensory information, allowing visitors to touch, smell, hear, and see animals (Patrick and Tunnicliffe, 2013). Inclusive design can therefore be used to increase access to important biological conservation education, encouraging mindfulness for people of all ages and abilities. Frost and Laing (2011) go as far as to say that zoological gardens are well suited to meet this objective, and should

seek to provide multisensory wildlife experiences to convey conservation education to a wide range of people.

Zoological gardens offer an immersive and naturalistic outdoor visitor experience (Braverman, 2013). They present an opportunity to engage with nature that is seldom found within built up areas, providing urban respite (Braverman, 2013); in fact some organisations offer visitors the opportunity to engage directly with animals, by feeding giraffes or cleaning elephants for example (Frost and Laing, 2011). This is particularly important regarding the biophilia hypothesis, which states that humans have a biological propensity and desire to connect with nature (Wilson, 1993).Visiting a zoological collection is also a multigenerational social event for many families (Garrett, 2014). It typically involves a shared experience, where people discuss and enjoy collectively, displaying positive emotions (Frost and Laing, 2011). Conversely, zoological gardens permit visitors to express and experience commonly perceived negative emotions, such as fear and disgust, albeit within a risk-free framework (Cushing and Markwell, 2011). Snakes are a useful case in point, often being perceived as slimy and revolting (Cushing and Markwell, 2011). An added benefit of the visitor experience is that older people in particular, associate animal encounters with unconditional affection, which is often lacking in a social context as people get older (Regnier, 2002). Consequently, there is a strong case for increased accessibility within zoological gardens, to meet emotional needs and aspirations, and to address a universal biological inclination to engage directly with nature.

Although preceding arguments have emphasised the value of zoological gardens for visitors, diverse visitor attendance itself is of value to zoological gardens, as regards the business case for inclusive design. This is because the vast majority are heavily reliant upon admission charges as their primary source of funding (Sheridan, 2013). Without sufficient levels of funding, conservation and education objectives cannot be fulfilled (Patrick and Tunnicliffe, 2013). At some zoological gardens, visitors are asked to make an additional donation to conservation initiatives as part of their admission fee or at specific on-site exhibits (Rees, 2011), augmenting the value of high visitation levels. In response to economic pressures, inclusive design can increase accessibility for visitors, increasing attendance and resultant profits, while ensuring that organisations do not overlook the spending power of older and disabled people. An added consideration

is that high attendance levels have a broader authority, positively influencing tourism economy within each zoological gardens catchment area (Frost, 2011).

A final important relationship between zoological gardens and inclusive design is that conducting case study research in this location set can compliment other specific case studies of distinctive environments, such as toilets or concerts. Findings from more than one environment can therefore be compared and contrasted to form substantiated conclusions. For instance, to increase the accessibility of live music, the Eden Project has provided hearing balloons to enable some people with a hearing loss to feel music through vibrations (Sensory Trust, 2013). Examples like this support the concept that context is highly influential concerning the unique implementation of inclusive design.

2.6 Conclusion

Inclusive design addresses the needs and aspirations of a diverse collective of generally marginalised users. More specifically, it assists older and disabled people by emphasising the importance of dignity and autonomy. In doing so, it increases accessibility for the wider population. Rather than attributing access issues to individual capability loss, inclusive design cites physical and social barriers as causes of disability. It is therefore closely aligned with the social model of disability. A detailed ethical and business case support the uptake of inclusive design. The ethical case calls for inclusivity to address social exclusion and quality of life concerns. The business case associates inclusive design with increased profitability, underpinned by irrefutable demographic data concerning Europe's ageing population.

Literature currently details a wide range of tools and resources to practice inclusive design. Cited arguments focus predominantly upon the value of engaging directly with end users to facilitate an understanding of accessibility issues. Although user involvement is advantageous, the scope of this process is customarily dictated by financial restraints. Using inclusive design as an analytical tool presents a number of inherent challenges. These challenges are diverse, yet all highlight how an increase in accessibility can be curtailed or altered by context. For this thesis, the most relevant argument is that the effectiveness of inclusive design is context dependant and that

failing to recognise this point can result in inappropriate or irrelevant guidance, which fails to take institutional nuances into account. The following chapters utilise zoological street furniture to illustrate this concept.

Taking the context of zoological gardens, inclusive design is particularly useful as it increases access to education and entertainment for a large and socially representative cohort of end users. An increase in accessibility can also allow people to connect with nature, fulfilling a universal human desire. Advantages for visitors aside, high levels of accessibility can increase profits through improved attendance, evidencing mutual inclusivity benefits for both zoological gardens and their visitors.

Chapter 3
Literature Review: Street Furniture

Existing inclusive design guidance for the installation of street furniture is the focus of this chapter. The chapter discusses the social value of street furniture before covering the specifics of seating, litter bin, and signage design. Detail is included on that which specifically addresses street furniture within zoological gardens. Guidance pertaining to airports and hospitals is also discussed, drawing attention to the influence of context upon the realisation of inclusive design[1].

3.1 Social Value

Street furniture refers to *'objects placed or fixed in the street for public use, such as post boxes, road signs, and benches' (Oxford Dictionaries, 2015)*. Inclusive street furniture helps to create open and welcoming public spaces for people of all ages and abilities, facilitating community engagement and social interaction (Global Alliance on Accessible Technologies and Environments, 2014). It is especially important for many older and disabled people, who can no longer drive and therefore walk outdoors more frequently (Burton and Mitchell, 2006). Concerning neurodiversity, conspicuous street furniture can function as a memorable wayfinding landmark (Mollerup, 2013).

The provision of accessible street furniture contributes to individual health and wellbeing by enhancing access to exercise, fresh air, and interactions with nature (Inclusive Design for Getting Outdoors, 2010). In turn, regular exercise can alleviate depression and promote healthy sleep patterns (Nussbaumer, 2012). Simply being outside in the sun is useful, due to the health benefits associated with Vitamin D absorption (Mitchell and Burton, 2010). A further significant contribution is that by increasing user diversity, inclusive street furniture can instil a feeling of safety and

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[1] Although the overall thesis argument is predicated on the influence of context, the access guidance cited in this chapter is not only from the United Kingdom. While it is acknowledged that this choice fails to reference regional ergonomic differences, these are deemed to be inconsequential compared to environmental factors and nuances, such as those found in a zoological garden. Furthermore, there is a wealth of practical guidance from outside the United Kingdom, which is put forward as being universal in nature.

security for minority groups (Bain, Gray, and Rodgers, 2012). Accessible street furniture makes a positive social contribution, and is an important component of public inclusive design, which addresses both physical and psychological welfare.

Independent living and access to services within a local community are aided by inclusive street furniture, as it allows older and disabled people to traverse their local environment with greater ease (Mitchell, Burton, Raman, Blackman, Jenks, and Williams, 2003). Most older people prefer to remain living in their own home rather than move to a care home, to retain independence (Hillier and Barrow, 2015), and accessible street furniture can support this typical aspiration. Staying in a familiar environment is of particular importance for people living with dementia, since moving elsewhere ultimately increases anxiety and confusion, and results in a loss of self-esteem (Burton and Mitchell, 2006). This example highlights the wide-ranging socioeconomic impact of inclusive street furniture. Inclusivity links to both the needs and aspirations of older and disabled people, and reduced care home costs.

3.2 Seating

For all outdoor locations, providing regular accessible seating ensures that rest areas are available for older and disabled people, and families with young children (Bonnett, 2013). This is particularly important for people who need to rest on a regular basis (Global Alliance on Accessible Technologies and Environments, 2014). During research interviews conducted by Burton and Mitchell (2006), older people cited a lack of accessible public seating as a main reason why they may feel uncomfortable going outdoors within their local community. In fact, 84% of residential streets in the United Kingdom have no seating provision and this inadequacy results in people sitting on unsuitable alternatives, such as low-level walls (Newton, 2012). To date there has been little consistency regarding how often outdoor seating is required. Literature suggests that seating be provided every 100 metres (Sawyer and Bright, 2014), every 50 metres (Smith and Dropkin, 2015), and every 30 metres (Global Alliance on Accessible Technologies and Environments, 2014). Despite this inconsistency, the underlying message is that increased provision is generally useful for all end users.

Both the regularity of seating provision and where it is located influence accessibility. There is a greater need for seating on long and inclined routes (Lacey, 2004), where people will need to wait (Sawyer and Bright, 2014), and next to steps, ramps, or any changes in level (Centre for Excellence in Universal Design, 2013). Outdoor seating should be placed only on firm and level ground (Canadian Standards Association, 2004). It should be situated next to an open space, which a wheelchair user can utilise to sit next to a seated person (Bonnett, 2013). If possible, space for two or more wheelchair users to sit next to one another will be made available alongside all outdoor seating (Grant, 2013). In addition, literature recommends making space available for working dogs (Sawyer and Bright, 2014) and pushchairs (Centre for Excellence in Universal Design, 2013), to enhance inclusivity.

Whilst inclusive street furniture can benefit end users, it can equally function as an access barrier. Street furniture that protrudes into a walkway, also known as street clutter, can be dangerous for people with a vision impairment, as well as for people who are not paying attention while walking (Burton and Mitchell, 2006). It is therefore advisable to position seating in an amenity area, adjacent to a walkway, but not on it (Global Alliance on Accessible Technologies and Environments, 2014). To assist recognition for all users, including people with a vision impairment, amenity areas should employ tonal and textural contrast, distinguishing them from main walkways (Global Alliance on Accessible Technologies and Environments, 2014). Furthermore, seating itself should contrast visually with its local environment, to reduce accidental collisions (Waterman, and Bell, 2011). Guidance concerning both street clutter and colour contrast relates not only to seating but also to other forms of street furniture, such as litter bins (Bonnett, 2013).

Practical considerations aside, regular accessible seating can increase opportunities for social interaction and positively influence the amount of time older people spend outdoors (Newton, 2012). As a result, it is useful to install seating at key destinations, such as close to local shopping facilities or public services (Newton, 2012). Positioning some seating at right angles helps people with a vision impairment or a hearing loss to communicate with others (Mitchell *et al*, 2003), enhancing inclusivity for marginalised groups. In terms of preference, it is important that accessible seating allows all users, irrespective of their age or ability, to enjoy picturesque views, or observe points of

interest, preferably in a quiet sheltered location (Centre for Excellence in Universal Design, 2013). Providing a mixture of fixed and loose seating can help too in this regard, catering to diverse end user needs and aspirations (Sawyer and Bright, 2014). For people living with dementia, the presence of outdoor seating can help to clarify the public nature of a location, enhancing orientation and understanding (Burton and Mitchell, 2006). Guidance detailed here highlights how seating functions beyond its apparent remit, aiding social interactions and wayfinding through inclusive design.

One of the most significant current discussions regarding inclusive seating relates to seat height. Older research participants have stated that they find low seats very uncomfortable (Newton, 2012), yet provision should be varied, to cater to the widest possible demographic. For this reason, the British Standards Institution (2009) recommends offering seating at a range of heights between 380mm and 580mm, based upon feedback from both disability groups and construction professionals. A seat height of around 480mm is most suitable for wheelchair users (British Standards Institution, 2009) and for individuals who have had knee or hip replacements (Newton *et al*, 2010). When numerous seats are provided, perching options should be offered, between 650mm and 800mm, as some people will find these easier to use (Lacey, 2004). For comfort and accessibility, a seat width of 500mm (Newton, 2012) and a depth of around 470mm (Vandenberg, 2008) are generally recommended.

Armrest and backrest provision also influences accessibility. Both armrests and backrests help people get up from, and lower themselves to, a seated position (Global Alliance on Accessible Technologies and Environments, 2014), with Vandenberg (2008) suggesting a 110 degree rake for backrests. As armrests can hinder wheelchair transfer, it is useful to offer seating both with and without armrests (Global Alliance on Accessible Technologies and Environments, 2014); however, varied seating within a single row can cause confusion for people with a vision impairment (Centre for Excellence in Universal Design, 2013).

While the arguments put forward in this section have predominantly focused upon increasing physical accessibility for end users, ambience should also be taken into account when outdoor street furniture is being installed. Bell (2008) argues that urban seating can look out of place in naturalistic and remote surroundings, suggesting that

designs that respond to the character of a location alleviate this concern. Wooden designs are typically useful in this regard, when the intention is to convey a rustic character (Bell, 2008). Related research has shown that wooden outdoor seating is preferred by many older users, as it is perceived to be warm (Newton *et al*, 2010). It is also believed to be more comfortable and less slippery than common alternatives such as metal or concrete, as well as being welcoming and attractive (Burton and Mitchell, 2006). While some older research participants have raised concerns regarding splinters and the ease with which wood can be vandalised, wooden seating is generally preferred by older people and is deemed to be more inclusive for the wider population (Newton, 2012).

For all forms of street furniture, clarity of function is required (Burton and Mitchell, 2006); a seat should look like a seat, so that people understand its purpose. Designs that are familiar are typically easier to understand and reduce confusion, especially for older people and people living with dementia (Mitchell *et al*, 2003). Direct feedback from research participants suggests that people living with dementia fail to understand modern street furniture installations, and therefore prefer traditional alternatives (Burton and Mitchell, 2006). Ashley (2002) puts forward a similar suggestion, arguing that traditional post boxes and telephone boxes in the United Kingdom communicate their function due to their eye-catching and iconic red livery, which offers a reassuring continuity. The key argument here is that familiar street furniture can enhance comprehension, reducing confusion and subsequently increasing accessibility.

Current literature offers specific design guidance regarding inclusive outdoor seating, for people of all ages and abilities, and concerning specific capability loss. However, far too little attention has been paid to inclusive zoological seating. As a result, zoological gardens cannot refer to nuanced guidance, which comprehensively addresses domain-specific concerns. Grant (2013) presents an exception to the rule, by referring to the need for clear views of animal enclosures from seated areas. Similarly, Trieglaff (2002) argues for the provision of seating close to animal enclosures to enhance the visitor experience, while Hitchman (2009) highlights requests from visitors for sheltered viewing areas at Dudley Zoo. These examples make only passing reference to zoological seating and do so primarily from a zoological perspective rather than an inclusive design point of view. Arguments regarding clear views of animals are

appropriate and relate to the visitor experience, yet they do not represent in-depth research explaining the unique nature of zoological seating accessibility.

3.2.1 Seating with Tables

Inclusive design guidance for outdoor seating extends to seating with tables, commonly referred to as picnic tables. Hopper (2007) argues that when more than one picnic table is provided, at least half must be accessible for wheelchair users. In terms of specific dimensions, the Canadian Standards Association, (2004) suggests an underside clearance of 680mm, as well as a seat width of 750mm and a depth of 480mm. Additionally, a clear space of at least 2000mm around the perimeter of a picnic table increases accessibility, especially for wheelchair users (Global Alliance on Accessible Technologies and Environments, 2014). Figure 3.1 shows an accessible picnic table in Newton Stewart, Scotland.

Figure 3.1: Accessible picnic table
Photography by Professor Marcus Ormerod

3.3 Litter Bins

There has been limited analysis of accessible litter bin provision within current literature. Research to date has tended to focus upon other forms of street furniture, such as signage, which is somewhat understandable as sign design presents a wider array of complex sub-topics. Despite this shortcoming, this section provides a summary of existing inclusive design guidance for outdoor litter bins. Ward Thompson (2007)

argues that littering in outdoor spaces has a negative impact upon the visitor experience. It is therefore important that litter bins are accessible, so that people of all ages and abilities can contribute collectively to maintain standards for others. With this in mind, litter bins should be positioned where people are most likely to require their presence, next to seating and picnic areas, for example (Shaftoe, 2008).

More so than for other types of street furniture, litter bins present ongoing maintenance concerns. As noted by Shaftoe (2008), they must be emptied on a regular basis to ensure functionality, albeit this depends upon ongoing usage rates. Burton and Mitchell (2006) advocate swing lids on litter bins, pointing out that these additions help shield against odours and discourage alleged pests. Equally, and to avoid receptacles being knocked over, Bell (2008) suggests they be permanently fixed in place. Overflowing litter bins can attract animals such as stray dogs, which are more likely to pose problems for people with a vision impairment (Raheja and Suryawanshi, 2014). Poor maintenance, and specifically dirt and damage, is also likely to reduce levels of colour contrast, which is again important regarding visual impairment (Bonnett, 2013). With specific reference to litter bins, regular maintenance directly influences inclusive design, creating appealing and accessible public spaces.

In terms of physical dimensions, and how these influence accessibility, the Centre for Excellence in Universal Design (2013) suggests that litter bins have openings at 1000mm, while the recommended overall height of receptacles is around 1300mm. Adhering to these dimensions ensures access for wheelchair users. Best practice guidance suggests that litter bins be installed at ground level, and not on raised platforms, to allow detection by cane users (Bonnett, 2013). It is also necessary to provide a buffer zone around public litter bins between 400mm to 1600mm, allowing people to successfully deposit waste (Bonnett, 2013).

The accessibility of zoological litter bins is not well documented. In fact, no direct references to this topic are currently available. Waters (2002) documented the prevalence and usage rates of litter bins at Surabaya Zoo (Java, Indonesia), whilst compiling general site observations, and Kohlenberg and Phillips (1973) looked at how factors such as temperature influenced usage rates at Woodland Park Zoo (Washington, USA). Although these references discuss zoological litter bins, they do not relate to

accessibility, nor is there any indication that their respective authors intended for the papers to do so.

3.4 Signage

A substantial amount of guidance has been published on inclusive signage design. Key topics include the use of text, types of imagery, and wayfinding, all of which relate directly to the needs and aspirations of older and disabled people. These topics are explained in this section, alongside a review of existing literature covering accessible zoological signage design. In closing, wayfinding for airports and hospitals is reviewed to lay emphasis on the manifold influence of context upon inclusive design.

3.4.1 Text

Current guidance suggests using a combination of upper and lower case lettering for text on signage to help people distinguish between different words (Hoefler, 2009). This approach means that messages can often be understood even when they are partly obscured (Hoefler, 2009). To increase legibility, only single words should be in block capitals (Steinfeld and Maisel, 2012). Signs that are designed to be read while someone is walking should have a text height of at least 50mm, while for other scenarios general best practice suggests making text as large as possible, within sensible limits (Gibson, 2009). More specifically, literature recommends *'a ratio of cap height to (minimum) reading distance of 1:250, so cap type that is 1cm high can be read 2.5 metres away' (Baines and Haslam, 2005: 199)*. In addition, letter spacing and line spacing on signage needs to be more pronounced than for print media (Gibson, 2009). Legible and large text on public signage is a topic of significance for all users, especially people with a vision impairment (Wilkinson, 2005). For this reason, signs designed for extended reading are best positioned at average eye height, to allow most nearsighted persons close access to information (Canadian Standards Association, 2004). Yet as pointed out by Ndhlovu Rooke (2012), the notion of an average eye height excludes children and wheelchair users, highlighting the value of signage provision at multiple heights. The average eye height of a standing adult is 1600mm, whereas the average eye height for a wheelchair user is 1250mm (Italian Ministry of Cultural Heritage and Activities, 2011).

Signage typically displays either a serif, sans serif, or ornamental typeface (Calori and Vanden-Eynden, 2015). Small finishing strokes are present as part of a serif font, while a sans serif font omits these features (Calori and Vanden-Eynden, 2015). For extended passages of text, a serif font is recommended as the finishing stokes increase legibility (Graves and Graves, 2012). Ornamental fonts are best avoided for public signage, as they can be difficult to read for people with a vision impairment (Wilkinson, 2005). In all instances, it is best to use italic or bold text to emphasise a word or phrase but not for extended passages of text (Wilkinson, 2005).

Colour contrast is a leading issue regarding accessible text, with Steinfeld and Maisel (2012) suggesting a contrast of at least 70% between sign content and background. Equally, signage backgrounds should contrast their local environment (Grant, 2013). Figure 3.2 illustrates effective colour contrast at the University of Chester. Older people will benefit more than others will from this guidance, since our capacity to differentiate between colours deteriorates as we age (Stockton, 2007). As colour blindness most typically causes difficulty distinguishing between red and green, or blue and yellow, these colour combinations should be avoided altogether (Wilkinson, 2005). Whitehouse (2000) describes the complications people face in detail, explaining that the difficulty is not in seeing these colours, but in distinguishing between them when they are in close proximity. For all end users, but particularly for people living with dyslexia, text should not be displayed against a patterned background (Conlon, 2012). Doing so can make information difficult to read (Conlon, 2012).

Figure 3.2: Smoking restriction sign illustrating effective colour contrast

The provision of tactile lettering and Braille on signage is also useful in terms of inclusive design, ensuring that the needs of people with a visual impairment are addressed (Grant, 2013). While this is true, materials that are to be touched should be carefully selected to avoid injury or allergic reactions; touching certain metals, for instance, can cause adverse reactions for some people (Centre for Excellence in Universal Design, 2013). When tactile information is provided, it should be raised between 0.8mm to 1.5mm (Canadian Standards Association, 2004). Figure 3.3 highlights the use of tactile lettering and Braille. Typical reach ranges need to be considered too, for people of all ages and abilities, including wheelchair users, who often find reaching to the front, side, and back difficult (Nussbaumer, 2012). Figure 3.4 (*Imrie and Hall, 2001: 11*) shows how ergonomics can inform the position of tactile data, further signifying the benefits of signage provision at more than one height.
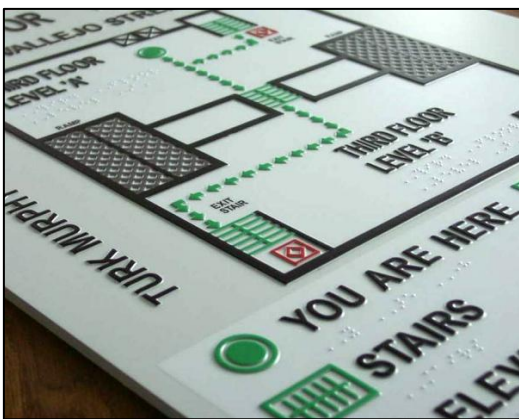
Figure 3.3: Tactile map - Photography by Eye Catch Signs
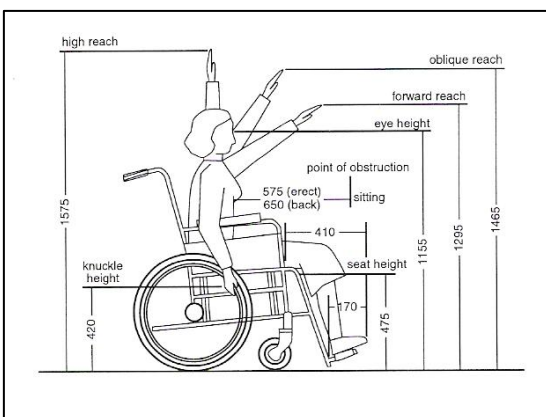
Figure 3.4: Typical reach ranges for an adult female wheelchair user[2]

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[2] Access dimensions in mm and dependent upon specific wheelchair type.

Although a wide variety of sign types within zoological gardens display text, what we know about this topic is almost exclusively limited to exhibit labels and the educational narrative they display. It has been suggested that for text on zoological signs, simple vocabulary should be used to engage young children (Yew, 1991). Primarily for children, analogous writing is advocated in a zoological context, as it enhances the visitor experience in a fun and imaginative manner; *'a rhinoceros is like a two-ton lawnmower' (Yew, 1991: 119).* In terms of inclusive design, these concepts are not only domain-specific; they also address the needs of a specific age group whom may be excluded by complicated verbiage and rhetoric.

Martin (2012) states that exhibit labels normally list a species common and Latin name, country of origin, and current conservation status, alongside information about natural habitats. Figure 3.5 presents an example from Emirates Park Zoo (Abu Dhabi, United Arab Emirates). Observing zoological garden visitors has shown that around 20% of people read exhibit labels and has suggested that species popularity can influence reading occurrences (Martin, 2012). In addition, visitor surveys have shown that people enjoy reading about animal diets more so than other topics (Bruce, 2010). Studies of this nature are useful from an education and visitor preference perspective, but do little to explore contextualised access to information concerns for older and disabled people, or offer related inclusive design discussion and guidance.

Figure 3.5: Blue monkey (Cercopithecus mitis) exhibit label

Concerning access to information, Rees (2011) states that Latin names are the same the world over, whereas common names are subject to localised variation, hence they are

more likely to be misunderstood by foreign visitors when displayed on exhibit labels. Conversely, Mullan and Marvin (1999) state that visitors are very unlikely to refer to Latin names and that they are only used by specialists. They describe Latin as the *'language of the learned' (Mullan and Marvin, 1999: 10)* implying that it is exclusionary to those who do not have the relevant education. Research conducted by Fraser, Bicknell, Sickler, and Taylor (2009) has shown that visitors normally find the inclusion of a Latin name to be the least interesting element of an exhibit label. A review of existing literature regarding this sub-topic fails to provide a definitive solution, yet it does highlight a domain-specific access to information issue. The conflicting needs of people who do understand Latin names and those that do not, question the effectiveness of inclusive design, while concurrently drawing attention to the unique nature of zoological street furniture.

3.4.2 Imagery

Accessible signage is naturally associated with the use of imagery as a means to overcome language and literacy barriers (Fielding, 2009). Imagery use is inherently inclusive, conveying a universal message via a single communication medium (Wyman and Berger, 2005). Signs displaying imagery are both simple and welcoming, thus they are recommended in terms of inclusive design best practice (Gibson, 2009). In addition, they aid quick comprehension of information in public areas (Abdullah and Hübner, 2007). The increase in multicultural urban locations further supports the rationale for imagery use on signage (Wyman and Berger, 2005).

Imagery displayed on public signage includes photographs, illustrations, silhouettes, icons, and pictograms (Wyman and Berger, 2005). The term visual synecdoche is used when any of these image forms display a small part of a larger entity, which they are designed to represent via means of an inherent connection, as opposed to a literal representation (Ambrose and Harris, 2006). There is currently a lack of available inclusive design guidance regarding the use of photographs and illustrations on public signage. Tinkler (2013) does however note that photographs can offer high levels of detail when compared to other visual mediums, without making specific reference to signage. Binder and Schöll (2010) have documented how farmers prefer photographs

rather than pictograms as they relate to their concept of reality. Additionally, Calori and Vanden-Eynden (2015) warn that designers should choose photographs and illustrations carefully when aiming to convey a clear message, to ensure that they enhance communication, rather than function solely on a decorative level. Regarding illustrations, Ambrose and Harris (2005) claim that they can be free of photographic constraints and thus offer enhanced clarity or abstraction, depending upon what is required.

Silhouettes reduce image detail to only a monotone outline, allowing designers to convey consistency throughout a design schema (Sherin, 2013). This lack of detail can allow focus to be placed upon a specific message, increasing impact, or alternatively silhouettes can be used to obscure potentially useful or relevant detail (Ambrose and Harris, 2005). From an accessible signage point of view, using silhouettes to focus viewer attention on a simple message is most useful. Figure 3.6, from Blackpool Zoo, shows this concept in practice; a reduction in detail highlights the recognisable outline of an elephant.

Figure 3.6: Keeper talk sign

Unlike silhouettes, which are literal outlines, icons are abstract graphic representations (Ambrose and Harris, 2005). Icons focus viewer attention by omitting superfluous detail, presenting a simplified single message in isolation, starkly contrasting the level of detail in photography (Ambrose and Harris, 2005). Figure 3.7 shows a typical icon for a slip warning from Blackpool Zoo; the icon is far from an anatomically correct outline of a person falling, yet it portrays its message clearly. Although icons can be used to overcome language barriers, Keates and Clarkson (2004) have observed how overly abstract representations can cause confusion for older people, and are also sometimes difficult for people with a vision impairment to understand.

Figure 3.7: Slip warning sign

The final image form, pictograms, communicate through association; *'the pictogram that resembles an airplane is not a sign for an airplane, but for an airport' (Kjorup, 2004: 3505).* Internationally recognised pictograms are the most widely used images for accessible public signage (Fielding, 2009), achieving clarity without the barrier of traditional language comprehension (Abdullah and Hübner, 2007). Pictograms are not pictures; rather they are pictorial representations (Abdullah and Hübner, 2007). Toilet pictograms, for instance, are typically displayed in public places and their meaning is widely understood (Kjorup, 2004). Fielding (2009) argues that comprehension of pictograms is dependent upon a combination of simplicity, legibility, and recognition. Thus, successful communication of a message is dependent upon its target demographic (Ambrose and Harris, 2005). Despite the ubiquitous nature of many pictograms, Rother (2008) has recorded confused interpretations of pesticide pictograms in South Africa, while Dowse and Ehlers (2004) have documented highly inconsistent levels of medical pictogram interpretation, also in South Africa. For people with a visual impairment,

pictograms are useful, but only if they are designed to draw attention to key information and remove fine detail (Katz, Kripalani, and Weiss, 2006). Interpretation issues, such as this, suggest that alternative communication mediums should be evaluated and considered for use, alongside a review of the context in which pictograms are to be displayed. Figure 3.8 shows an example of a pictogram sign from London Zoo.

Figure 3.8: Bite warning sign

Imagery use on zoological signage varies greatly, due chiefly to the cornucopia of species housed within the United Kingdom. With specific reference to exhibit labels, Martin (2012) states that both species distribution maps and animal images are commonly displayed, as shown in figure 3.9 from Dudley Zoo. Empirical evidence provided by Yew (1991) shows that imagery on zoological signs is far more likely to be creative, humorous, and even whimsical, compared to that found in a typical high street; using tombstone imagery on signs about extinct species, or using the body of a snake to spell out the word zoo, for instance.

Figure 3.9: Bornean orangutan (Pongo pygmaeus) exhibit label

Literature illustrates the inherent and unique nature of imagery on zoological signs, thus beginning to describe, if not explain the topic. What is not present is a comprehensive explanation of how these issues relate to inclusive design. Despite this uncertainty, a number of paradigmatic design classics can be used to inform current practice. The work of Lance Wyman, who designed a series of icons for the National Zoological Park (Washington, USA), is highly acclaimed (Dugdale, 2005). Figure 3.10 shows how species type is conveyed with simplicity, clarity, and consistency in an unmistakable stylised manner. Yew (1991) argues that the icons designed by Wyman help young children find exhibits easily, further advocating designs of this nature to increase accessibility. As pointed out by Prosser and Burke (2008), words alone are disempowering to most young children, being understood at a far more sophisticated level by the majority of adults. Conversely, imagery is more likely to be understood by children and adults on as equal terms as is possible (Prosser and Burke, 2008).
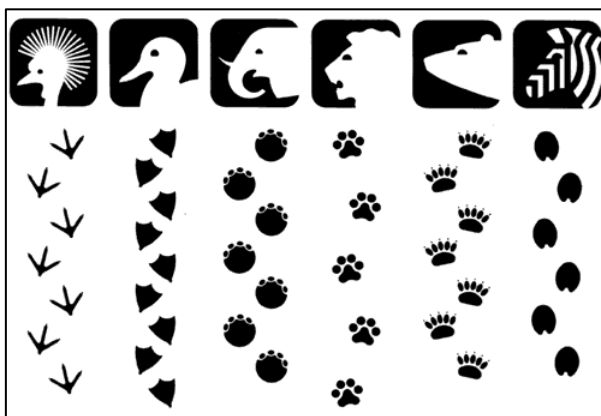
Figure 3.10: Series of zoological icons
Design by Wyman and Cannon Limited

3.4.3 Wayfinding

Literature states that wayfinding design facilitates orientation and navigation (Fielding, 2009). It reduces environmental complexity, allowing people to make route decisions and to undertake a process of continual route monitoring, prior to arrival at a desired destination (Fielding, 2009). The reduction of environmental complexity is more important than ever before, due to the ever-increasing size and density of many urban

environments (Berger, 2005) and expanding urban populations (Norgate and Ormerod, 2012). Furthermore, building ownership and function is increasingly transient in urban areas, highlighting the need for clear, understandable, and up-to-date wayfinding messages that respond to changing environments (Steinfeld and Maisel, 2012).

The importance of wayfinding is augmented by the prevalence of illogical layouts and inconsistent signage in many public spaces, which are often particularly confusing for people living with learning difficulties (Fielding, 2009). Research observations have indicated that wayfinding cues are also vital for older people who are more likely to fear getting lost, and for people living with dementia, who are more likely to become confused or apprehensive if route information is ambiguous (Burton and Mitchell, 2006). Indeed, clear and reliable wayfinding design can contribute to emotional wellbeing, eliminating feelings of isolation and the stigma associated with being lost in a public space (Steinfeld and Maisel, 2012). The notion that people get lost due to inadequate wayfinding cues, as opposed to their own shortcomings, is linked directly to the social model of disability. This point places the importance of wayfinding within an inclusive design framework.

Directional, orientation, identification, and regulatory signage all contribute towards wayfinding, although directional signage is most obviously related (Huelat, 2007). From an inclusive design perspective, it is useful to communicate wayfinding information using tactile, auditory, and olfactory means, as opposed to offering only visual data (Grant, 2013). In bilingual environments, it is often necessary to list text in more than one language (Gibson, 2009). Beyond signage, a wide array of environmental data can contribute to a wayfinding paradigm; landmarks for example can be used to determine location or to make directional choices (Afrooz, White, and Neuman, 2014). Evidence from empirical studies suggests that for older people in particular, distinctive and memorable landmarks reduce disorientation and agitation, and may be more important to wayfinding than signage itself (Mitchell *et al*, 2003). One argument put forward is that landmarks aid wayfinding as they offer a lasting visual memory; therefore, people are more likely to remember landmarks, rather than street names and other non-visual cues (Norgate and Ormerod, 2012). Landmarks offer significant wayfinding cues, yet most related literature cites signage as the focal point of a comprehensive wayfinding paradigm. As a result, signage dominates the discussion put forward in this section.

Directional signs characteristically display text and symbols, with the latter adding simplicity and clarity to overcome language barriers (Wyman and Berger, 2005). Research participant feedback has suggested that some older people find a combination of text and imagery to be confusing (Newton *et al*, 2010). However, presenting both text and imagery caters for different cognitive skills. A number of people will prefer written instructions, while others will respond to visual cues (Huelat, 2007). To cater for the widest possible demographic the use of both text and imagery is generally desirable.

Mollerup (2013) argues that all elements of directional signage design should be comparable and coordinated within a specific environmental framework, to aid wayfinding comprehension. In relation to this topic, Norgate and Ormerod (2012) advocate the consistent design of signs and tactile surfaces to aid wayfinding for people with a vision impairment. According to Gibson (2009), all typographic elements of a directional sign should be on a comparable scale. This means that an arrow, image, and text on a sign ought to flow seamlessly as the elements are read from left to right. Nevertheless, signage hierarchy needs to be considered, meaning that destinations that are more important typically necessitate larger and more prominent wayfinding messages (Calori and Vanden-Eynden, 2015). An additional consideration is the use of consistent nomenclature on directional signage to avoid end user confusion (Rose, 2015). In relation to this issue, information on signage should match that used on associated websites and leaflets (Southwell and Findlay, 2007).

Nussbaumer (2012) suggests using different themes or colour schemes on directional signage to differentiate it from other sign types and to identify specific zones and functions within an environment, building upon the argument that unified and salient signage within a set location can communicate as well as add to a sense of place and identity. Colour coding is an effective tool to overcome language and literacy barriers within the built environment (Imrie and Hall, 2001), though it is generally not as helpful for older people who are less able to tell different colours apart (Mitchell *et al*, 2003). Best practice suggests using no more than six different colours for wayfinding signs, within a specific environmental framework (Wyman and Berger, 2005).

Feedback from older people suggests that directional signs be displayed singularly, as multiple pointer arrows can be confusing, due to an abundance of complicated information (Burton and Mitchell, 2006). Too much wayfinding information can be as detrimental to both orientation and navigation as a lack of signage, causing uncertainty and frustration (Southwell and Findlay, 2007). Hence, directional signs should display short and simple messages to increase comprehension (Lacey, 2004), with no more than three different destinations being listed on any one sign (Huelat, 2007). However, Ferrara (2009) suggests that an initial lack of signage leads to the use of poor quality temporary installations, which ultimately result in more signs than are actually needed. In sum, wayfinding should be supported by as few simple and clear signs as necessary, but no less (Mollerup, 2013).With this in mind, a specific and effective technique is progressive disclosure, where people are given only enough information to move from one decision point to the next (Huelat, 2007).

It is important to position directional signs in an overhead position (Steinfeld, 2011), with reference to normal circulation routes and at key decision points, where people are most likely to require and see route decision information (Mitchell *et al*, 2003). When signage is positioned overhead, a vertical clearance of 2300mm is recommended to accommodate most people (Centre for Excellence in Universal Design, 2013). On long pathways, there may be a need to reinforce wayfinding cues on a regular basis (Calori and Vanden-Eynden, 2015), and too display time and distance indicators to aid planning (Mollerup, 2013), as well as stating which services are available *en route* (Yew, 1991). In terms of repeat visitation to a specific location, temporary directional signs are particularly confusing; hence, it is preferable to use only permanent installations (Burton and Mitchell, 2006).

For wayfinding design to be effectual, directional information needs to be supported by orientation, identification, and regulatory messages (Southwell and Findlay, 2007). Orientation signs provide an overview of a space, normally through maps and directories, and should share a coordinated relationship with other signs (Gibson, 2009). To increase comprehension for the wider population, Gibson (2009) recommends using 'you are here' indicators on outdoor maps and displaying directories in alphabetical or numerical order whenever possible. Equally, Steinfeld (2011) promotes the use of tactile maps to increase levels of detail, not only for people with a vision impairment,

but also for all other end users. For all map types, scale is a particularly relevant consideration, given that most people cannot comprehend their immediate vicinity beyond 600 square foot (c. 56m^2) (Berger, Corbin, Vignelli, and Katz, 2005). Finally, maps should most prominently highlight the location of important destinations which people are most likely to visit (Huelat, 2007), and display imagery to increase the number of visual cues available to end users, especially regarding low literacy levels (Berger *et al*, 2005).

Identification signs are an important wayfinding component, as they convey the name and function of a location, while concurrently emphasising its character and nature (Gibson, 2009). They establish a sense of place and confirm arrival (Vandenberg, 2008). Logo design represents a key element of identification signage. Logos are defined as *'a graphic element to identify a company' (Adîr, Adîr, and Pascu, 2014: 140).*The use of a company logo on wayfinding signage offers visual confirmation that messages come from the same source and that they are interrelated (Huelat, 2007). It is proposed in relevant literature that logo designs, akin to many other visual outputs, should utilise imagery to convey a message, which is both vibrant and internationally comprehensible (Airey, 2010).

Regulatory signs aid orientation and navigation by establishing warnings or instructions (Gibson, 2009). Table 3.1 details the different types of regulatory sign. Messages need to be clear due to health and safety concerns, yet wording must be chosen with care; visitors to a public place, especially in a leisure and recreation context, seldom want to be told what they can and cannot do in an authoritarian manner (Gibson, 2009). As a general rule, darker colours are useful for regulatory signs, as they are deemed to be more credible and assertive (Eiseman, 2009).

Sign Type	How to Recognise?
Warning sign	Yellow triangle with black border and black symbol
Prohibition sign	Red ring and diagonal bar with black symbol on white background
Mandatory action sign	Blue circle with white symbol
Safe condition sign	Green square with white symbol
Fire safety sign	Red square with white symbol, and always including representation of flames in white
Sign Type	What is the Type of Safety Message?
Warning sign	Warns of hazards which could result in personal injury or threat to health
Prohibition sign	Specifies behaviour that is prohibited because it would result in an immediate or potential risk of personal injury or threat to health
Mandatory action sign	Specifies an action required to safeguard personal health and/or avoid risk of personal injury
Safe condition sign	Identifies evacuation routes and assembly points. Indicates the location of first aid and emergency equipment or a safety facility or a safety action
Fire safety sign	Indicates the location of fire equipment

Table 3.1: Types of regulatory signage
(International Organization for Standardization, 2013: 28-32)

It is not only essential to increase access to wayfinding information, but it is also necessary to convey information explaining which circulation routes are accessible to different end user groups. Displaying the international symbol for accessibility confirms to people that a specific route is judged to be accessible for disabled people, as well as indicating the presence of accessible parking bays, and other accessible facilities, such as toilets (Noble and Lord, 2004). As a general rule, accessible routes are at least 915mm wide, have firm slip resistant surfaces, and provide ramps or lifts for any changes in level (Jefferis and Smith, 2010). Guidance suggests displaying the international symbol for accessibility to direct people towards an accessible route, where one commences, and at junctions between accessible and non-accessible routes (Hopper, 2007). This symbol or pictogram is particularly useful in terms of universal wayfinding comprehension, as it is used internationally (Vavik and Gheerawo, 2009).

Figure 3.11 highlights its use at Manchester Metropolitan University. As an aside, it is worth noting that an accessible route is not necessarily inclusive, as it can be argued that all routes should be accessible, hence removing segregation, and the need for additional signage. Therefore, the very concept of a separate accessible route is redundant if inclusive design practice is implemented.

Figure 3.11: Accessible route sign

In a closing statement for this section, it is appropriate to acknowledge the relationship between physical street furniture and technology, which is most significant with reference to signage. Calori and Vanden-Eynden (2015) argue that although mobile technology can enhance wayfinding practice, physical signage will continue to be essential, due to a number of inherent advantages, not limited to obvious cost differences. Whereas technology is generally reliant on a power source and a digital signal, physical nonelectronic signage is not (Calori and Vanden-Eynden, 2015), increasing dependability and reducing costs. Moreover, some people may not own or want to use the required technology (Mollerup, 2013). Even users of global positioning systems remain heavily reliant on other wayfinding cues to support their uptake of technology (Norgate and Ormerod, 2012), illustrating the longevity of physical signage in a digital age. An added concern is that the creative possibilities of the electronic medium, influence playful design approaches that negatively influence accessibility. The Canadian Standards Association (2004) highlights this issue in relation to the speed of scrolling text, advocating slow moving letters and images in all instances. Finally, due to the relative youth of this area, existing inclusive design guidance fails to provide suitable advice on how best to ensure access needs are met through the use of technology (Biswas *et al*, 2012). In light of these many points, the author subscribes to

the notion that technology should be used to enhance traditional street furniture, rather than as a means to replace it. However, it is accepted that digital signage offers greater scope for updated and customised displays, which specifically address individual user needs; altering the language or reading age on display, for example (Calori and Vanden-Eynden, 2015). Figure 3.12 shows why digital signage is useful; in this case, the ability to update the display relates directly to ever-changing train schedules.

Figure 3.12: Train departures sign
Photography by Napier Park

3.4.3.1 Context

Gibson (2009) highlights the relationship between successful wayfinding design and context. He advocates a deep understanding of the nature of the environment being designed for and the people who frequent it and how they behave, with reference to their needs and aspirations; designing signs for patients in a hospital requires a quite different approach than that for theme park visitors. Jovial signage may contribute to the visitor experience in one, while being completing inappropriate in the other. Understanding context is also a cost saving measure, as it reduces instances were unsuitable wayfinding signage is procured (Ndhlovu Rooke, 2012). Another consideration is that in some locations wayfinding itself is part of service provision for customers, yet in other environments, the concept of commercial benefits is immaterial (Norgate and Ormerod, 2012). Recognition of these points influences all aspects of a wayfinding paradigm from the use of vernacular, to the location and frequency of signage. This section looks specifically at unique wayfinding design guidance for airports and hospitals, as well as zoological gardens. Presenting this guidance further

strengthens the argument that decontextualised inclusive design is ineffective. Due to the shortage of wayfinding literature concerning zoological gardens, this section draws attention to a specific knowledge gap and contributes to the overall message that zoological street furniture research is in short supply.

General best practice guidelines, such as the need for consistent and hierarchical signage, are applicable within airports; however, there is also a need for context specific issues to be considered due to an inherent complexity. Research has shown that due to the stressful nature of airports, people consider wayfinding to be especially important (Churchill, Dada, De Barros, and Wirasinghe, 2008). With this in mind, professional signage reinforces crucial confidence in aviation (Mollerup, 2013). More so than in many other locations, wayfinding signs in airports must cater for global dialects, yet it can be argued that eye-catching signage is less important as passengers are already highly motivated to seek out information (Mollerup, 2013). As people in an airport are typically adhering to a timescale, concise signs are highly valued (Airport Cooperative Research Program, 2011). When complex messages must be displayed, flight information, for example, there is an increased need to allow simultaneous viewing by multiple end users (Taylor, 2005). Regarding flight information, digital displays are crucial as information can be updated instantly to reflect travel delays (Steinfeld, 2011), highlighting a contextual fit for wayfinding technology in airports. All of the aforementioned guidance contributes to a reduction in passenger stress, which can increase on-site retail spending; therefore, there is an enhanced economic case for effective wayfinding design for airports (Airport Cooperative Research Program, 2011).

Wayfinding design for healthcare facilities presents several distinct challenges, underpinned by an increased number of older and disabled people (National Health Service Estates, 2005) and the likelihood that illness will adversely affect wayfinding ability (Huelat, 2007). Clear and legible signage is imperative as most hospitals convey very limited spatial differentiation (Leibrock and Harris, 2011). Wall and floor finishes and colours, for example, are often identical throughout a site, due to maintenance policies (Leibrock and Harris, 2011). Comprehensible signage reduces occurrences of people asking staff members for directions, while helping people to be on time for appointments (National Health Service Estates, 2005). The relationship between effective wayfinding and increased staff productivity and concentration is particularly

important in a hospital or other healthcare setting, as it directly influences the wellbeing of on-site patients (Jacobson, 2005). A final wayfinding consideration for healthcare facilities is the potential for confusion caused by the use of specialist medical terminology (National Health Service Estates, 2005). Therefore, identification systems displaying numbers, letters, and symbols, rather than words, are more useful in a hospital setting than in other analogous location sets (Jacobson, 2005).

Few studies refer directly to zoological wayfinding, yet those that do illustrate a number of domain-specific issues. Shettel-Neuber and O'Reilly (1981) noted that people prefer a suggested path, rather than one of their own choosing. Sakai, Yoshida, Kakiyama, Komiya, Suda, Takemoto, and Yoshino (2010) found that people liked the inclusion of animal pictograms on directional signs and wanted wayfinding to be fun and to build expectations. In relation to this topic, Yew (1991) states that although wayfinding is important, signs should not detract visitor attention away from animal exhibits, therefore wooden naturalistic designs that complement their surroundings are highly appropriate. Developing this argument further, Rees (2011) suggests that for zoological gardens physical signs are less important as visitors will rely upon hand held maps. However, when directional signs are displayed they should utilise both imagery and text, as doing so helps children and foreign visitors, whom make up a high percentage of the visitor profile (Rees, 2011). The central message presented in this section is that akin to airports, hospitals, and other nuanced location sets, zoological gardens require a domain-specific approach to wayfinding, and street furniture accessibility in general. Thesis content argues that without such an approach, the application of inclusive design ideals will be ineffective due to a lack of congruity.

3.5 Conclusion

This chapter has presented a great deal of detailed guidance regarding the provision of accessible street furniture for outdoor spaces. Much of the literature has universal relevance; however, a central argument has been put forward illustrating the influence of context upon the validity and utility of existing guidance. The paucity of detailed research concerning zoological street furniture accessibility or any form of synthesis on this topic highlights a knowledge gap. Thesis output explains how this topic can be

addressed through the use of existing guidance (Chapter 5). It also takes an alternative perspective, arguing for domain-specific concerns to be taken into account, thus questioning the applicability of current inclusive design orthodoxy (Chapter 6). Accessible street furniture has an inherent and diverse social value, assisting people of all ages and abilities. It is argued that this value can be augmented by a consideration of milieu, which in turn increases the contextual fit and resultant applicability of access guidance.

Chapter 4

Research Approach

This chapter explains how research has been designed and conducted to address the thesis aim. Epistemology, theoretical perspective, research methodology, and methods are all discussed and established, to identify and justify appropriate selection. Relevant issues, such as research ethics and data analysis are also discussed. Figure 4.1 provides a methodological overview:
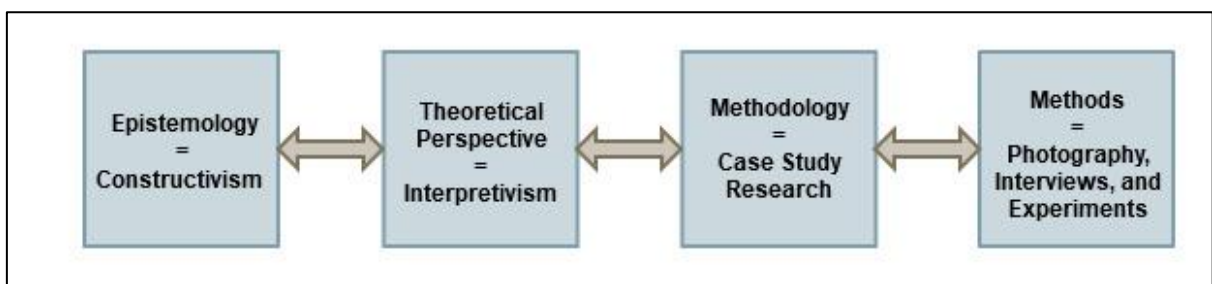
Figure 4.1: Methodological overview

Gray (2014) describes an interrelationship between epistemology, theoretical perspective, methodology, and methods when undertaking a research project. His concept of what should be established as part of research planning is utilised for this thesis, although it is acknowledged that it is adapted from Crotty's (2005) seminal writing on the topic. Gray (2014) describes how each element of research planning influences the other, in a sequential order. For example, the methods chosen should directly reference the research methodology in the same way that the theoretical perspective should directly reference the epistemology. The key point being made is that the choices made by a researcher should not be contradictory; claiming to have a constructivist epistemology and then aligning one's self with a positivist theoretical perspective would create an incongruous research project (Knight and Turnbull, 2008), as will be explained in more detail in this chapter. Following this guidance has allowed the philosophical concepts that underpin the research in this thesis to be consistent with the research output.

4.1 Epistemology

The nature and legitimacy of knowledge constructs is the focus of epistemology, which is defined as *'how we come to know about what exists' (Schuh and Barab, 2007: 68)*. The author subscribes to a constructivist epistemology, which claims that knowledge is uniquely constructed and interpreted by each individual due to his or her own personal experiences (Barbour, 2014); therefore, knowledge does not exist without the individual. Only through their interpretation is it formed. This is aligned with the notion that knowledge is a relative and provisional expression, as opposed to being timeless and universal, due to mediating cultural factors (Knight and Turnbull, 2008). The opposing view is that of the objectivist, who believes that knowledge exists independently, irrespective of any human interpretation (Egbert and Sanden, 2014). Due to this line of thought, personal interpretation is not valuable, as truth can be observed objectively (Egbert and Sanden, 2014). It is important to examine epistemology at the outset of an academic project, to establish secure foundations from which research can proceed (Knight and Turnbull, 2008).

4.2 Theoretical Perspective

Literatures describes theoretical perspective as *'the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria' (Crotty, 2005: 3)*. Whereas epistemology has very broad implications, theoretical perspective relates more specifically to research practices by describing an established theory, which a researcher can apply to study phenomena within a recognised framework. For this thesis, interpretivism was chosen as the theoretical perspective. An interpretivist approach describes a philosophical viewpoint, claiming that research findings are subject to multiple interpretations and that objectivity is generally an unrealistic ideal in social research contexts (Egbert and Sanden, 2014). Society and the individual are inexorably linked; meaning research output by an individual is determined by their social framework (O'Donoghue, 2007). From this description the synergy between epistemology and theoretical perspective, and consequently constructivism and interpretivism, is apparent. Thesis content highlights numerous examples of how an underlying interpretivist theoretical perspective has

influenced research output, by placing value upon *sui generis* interpretations of contextualised knowledge, provided by case study interviewees. What is also relevant is that interpretivism allows many individual viewpoints to influence research findings and this is evidently useful in terms of a consideration of the different accessibility needs of diverse end users.

At this point, it is appropriate to examine positivism, as this theoretical perspective is positioned in principal to oppose interpretivism; hence, a review of its proposals helps to establish why it was not selected for this thesis and why interpretivism was chosen. Positivism states that only factual measurements are valuable for research purposes and thus scientific observation should be employed to verify, without reference to philosophical speculation (Gray, 2014). The credibility of a positivist approach within a built environment framework is questioned by Dainty (2008), who suggests that as people are the object of such research, failing to explore human behaviour represents a narrow and outdated traditional adherence. Different research paradigms result in diverse forms of knowledge, yet as a positivist theoretical perspective does not address social phenomena (Dainty, 2008) it is arguably inimical to inclusive design research. A positivist theoretical perspective fails to recognise the rich social insights required to understand the diverse needs and aspirations of all people but especially older and disabled people.

4.3 Methodology

Jonker and Pennink (2010) describe methodology as the manner in which research is conducted, placing emphasis upon decisions made by the researcher in this regard. Based upon a rationale detailed in this section, case study research was selected as the singular research methodology for this thesis. The work of Yin (2009) has underpinned the selection. Specifically his guidance on how to plan, design, prepare, collect, analyse, and share, with reference to case study research, is used to structure the methodology narrative presented here.

4.3.1 Plan

Initially, it is important to establish what case study research is and why it is being used, when compared to other alternative methodologies. Although it is acknowledged that case study research can be described as a research method, Baxter and Jack (2008) argue that it is a methodology, rather than a method, which combines different methods to triangulate data. To define the term further they state that case study research must be both contemporary and complex, and investigate phenomenon in a natural context. Yin (2009) offers a comparable definition of case study research as a methodology; however, he adds that it involves empirical inquiry and evaluation, and that it is best employed when the relationship between phenomenon and context is diffuse. He also states that case study research is best suited when a researcher has no control over behavioural events. As a final point, case study research should have clearly defined boundaries, determined by a research aim (Elger, 2010). For this thesis, case study research has been employed as a methodology, not a method.

When conducting case study research the author had no control over the accessibility of zoological street furniture and was employing empirical inquiry to analyse current artefacts in their natural environment, rather than historical records, for example. Additionally, due to the complexity of the zoological domain the use of multiple methods to triangulate data allowed for converging evidence from literature, photography, interviews, and experiments. To present a comparative example, had a history rather than a case study been undertaken there would have been less opportunity to present convergent data, as it would not have been possible to conduct the experiments that took place. Equally, only conducting experiments would not have led to the initial observations that revealed the need for the experiments to have taken place. The ability of case study research to explore a relationship between phenomenon and context is of most relevance to this thesis, due to the research aim. Prior to this study, how the effectiveness of inclusive design as an analytical tool is influenced by institutional context was not well documented. Moreover, a knowledge gap existed regarding the relationship between inclusive design and zoological street furniture. Compared to a single experiment, which separates phenomenon from context to allow for detailed study of selected variables, case study research embraces context through

contemporary empirical inquiry (Yin, 2009). Therefore, it facilitated bound research with reference to the thesis aim. This combination of points rationalises the selection of a case study research methodology. Unlike with reference to the selection of epistemology and theoretical perspective, there was no prior commitment to case study research; it was selected solely due to its compatibility with the research aim.

Findings from photography, interviews, and experiments (methods) are incorporated into case study research (methodology) for this thesis, rather than reported separately alongside case study findings. The use of research methods has been governed by case study procedure, presenting a clear hierarchy. Mixed methods research has not been undertaken, based on Yin's (2009) description of the concept, which states that mixed methods occurs when case study research is incorporated into a larger and previously established study. He argues that when case study research encompasses other research methods it is not a mixed methods approach.

Case study research can be categorised as being exploratory, descriptive, or explanatory (Hancock and Algozzine, 2011). Exploratory research explores an unknown phenomenon, often to address uncertainty, before a precise aim or methodology has been established (Yin, 2012). It typically only functions as a prelude to more detailed research as description and explanation are both limited or omitted (Zainal, 2007). This approach would not have been useful for this thesis, as it would have limited the output to an initial process of documenting zoological street furniture through photography, without any of the subsequent description of what was recorded or an explanation of how the findings contributed to an enhanced understanding of the functionality of inclusive design, as an analytical tool.

Gray (2014) states that descriptive case study research provides a focused account of a current situation, in a natural state, and suggests that highly developed descriptive studies can incorporate a normative perspective, which compares what has been described to a recognised theory or standard. Zainal (2007) argues that descriptive research must be based upon a recognised theory or it will be deficient in academic rigor. However, even when a theory is applied to shape descriptive study, this form of research is still restricted, as it lacks explanation beyond an account of what currently exists. The primary difference between a descriptive and an explanatory approach is a

distinct lack of any explanation, or series of judgments, concerning causality (Tobin, 2010). For this reason, descriptive research was not selected as an appropriate classification for thesis output; simply describing the accessibility of zoological street furniture would not have contributed to a broader understanding of the effectiveness of inclusive design as an analytical tool. It can be argued that the author's MA work included a descriptive study, in the form of a documentation and cursory review of the accessibility at Chester Zoo (Richards, 2009), which in turn prompted the author to undertake further research.

The third category, explanatory, refers to the most detailed form of case study research. This approach combines the other two categories and thus involves exploring and describing phenomenon in an attempt to explain relationships (Gray, 2014). Explanatory research focuses upon how and why in relation to an event or phenomenon (Yin, 2012). Thesis output details both how and why institutional context challenges the effectiveness of inclusive design, using an illustration of the unique nature of street furniture within the zoology domain. It does so using casual reasoning, which is different to cause and effect procedures for experiments as it enriches understanding through an explanation of cause, as opposed to only establishing that such a relationship exists (Yin, 2012). Explaining causality and causal mechanisms in terms of their affect is therefore central to explanatory case study research. In addition, De Vaus (2005) describes how explanatory study is traditionally driven by existing theory or undertaken to test theory application, further justifying the selection of this research classification.

The final phase of planning to conduct case study research is to acknowledge and address traditional academic prejudices against this methodology selection (Yin, 2009). Researcher bias is listed by Neale, Thapa, and Boyce (2006) as a common disparagement, yet as this thesis operates within an interpretivist framework, bias is accepted and explained. The author's own bias relates most pertinently to a desire to promote and explore inclusive design, while each interviewee and experiment participant had his or her own personal position. In support of the author's position, Thacher (2006) argues for the use of case study research as a vehicle for ideals and values, which authors believe, should be pursued. For most of the interviewees, bias represented a desire to consider zoological issues such as animal welfare, conservation, and education and subsequently help progressive zoological gardens to develop. The

coming together of these opposing priorities raised a number of conflicts of interest. This helped to explore the limitations of inclusive design and hence bias served as a basis for knowledge creation rather than a methodological flaw. A general approach to weaken bias claims when conducting case study research is to triangulate data (Foley, 2010). Doing so allows findings to be drawn from a comparison and integration of both qualitative and quantitative methods (Markula and Silk, 2011). Photography, interviews, and experiments have all provided convergent evidence for this thesis, to diminish bias claims.

A second common criticism of case study research is that it cannot be used to form generalisations (Gomm, Hammersley, and Foster, 2000). Again, it is accepted from an interpretivist theoretical perspective that the author's output is unique and had the research been undertaken by someone else it would have produced a number of different findings and subsequently altered generalisations. Conversely, some of the case study findings would have been observed by most researchers who had applied inclusivity principles to the zoology domain. Rowley (2002) suggests that irrespective of theoretical perspective, researchers should opt to conduct multiple, rather than singular case studies whenever possible, to allow for the creation of generalisations. She suggests that case study research should create generalisations that are linked to a previously developed theory, describing such constructs as analytic generalisations. For this thesis, using inclusive design as an analytical tool, across four case studies, offered convergent evidence concerning the effectiveness of an inclusive design analysis and the unique nature of zoological street furniture accessibility. This in turn allowed analytic generalisations to be formed. If more time and funding had been available, it would have been preferable to conduct additional case studies. However, Rowley (2002) suggests that due to the complex and varied nature of this form of research, there is no predetermined number of cases that should be undertaken to form analytic generalisations. She states that the number required is determined by a studies design. Gerring (2007) warns that a review of too many cases inevitably limits how intensively incidences can be studied from a qualitative perspective, further justifying the selection of four cases. It is more likely that insight will arise from close engagement with a relatively small number of cases, than it is when hundreds are studied (Gerring, 2007). A further problem is that reviewing a large number of cases typically presents greater challenges concerning assumptions of homogeneity (Khan and VanWynsberghe, 2008).

Generalising statements made from an interpretivist perspective, present a complex relationship between the value of individual interpretation and that of broad and verifiable claims. Therefore, they are perhaps best described as speculative generalisations, which infer something about wider society from a subjective interpretation of a number of specific instances (Williams, 2000). An interpretivist perspective allows for micro-level, detailed, and contextualised study, which can be highly revealing in broad terms, despite stemming from the micro-level (Williams, 2000); using zoological gardens to learn about inclusive design, exemplifies this notion. In addition, Blaikie (2010) highlights the connection between an interpretivist perspective and being able to establish what constitutes the social world. What has been revealed can subsequently be the focus of future research. For this thesis, only through subjective observation was it possible to identify nuanced accessibility problems, which led to not only an evaluation of inclusive design, but also to expedient and relevant questioning for case study interviewees. The interviews could not have been conducted without the initial observational research, which established the nature of zoological street furniture accessibility.

4.3.2 Design

Fundamentally, case study research design is about logically linking the research aim and scope, to procedures for collecting and analysing data and forming conclusions (Yin, 2009). Choosing the unit of analysis and selecting the case study sites present applicable examples, as what has been selected must be able to provide data to realise a studies aim. Items of street furniture are the unit of analysis for this thesis. The case study sites are all zoological gardens. These selections are cogent and relate to the thesis research aim.

It is acknowledged that zoological gardens are home to other important access issues, which do not relate to street furniture. For instance, inclusive design guidance recommends the provision of graspable handrails along the entire length of external staircases (Global Alliance on Accessible Technologies and Environments, 2014). However, staircases are not street furniture, and therefore issues such as this are not part

of the thesis output. This is important, as Baxter and Jack (2008) argue that a common pitfall concerning case studies is that researchers attempt to study too broad a topic. Investigators typically fail to offer concise definitions or delimit research clearly enough to facilitate data collection (Baxter and Jack, 2008). There are also a number of domain-specific access issues, which are beyond the thesis remit. Figure 4.2, from Emirates Park Zoo, (Abu Dhabi, United Arab Emirates) shows how walls and archways can function as animal-themed wayfinding cues; in this case, visitors can presume that should they pass through the archway they will head towards a type of elephant enclosure. Although the use of wayfinding animal imagery would not normally be found outside of a zoology context, the thesis omits topics such as this due to an exclusive focus upon street furniture. It is argued that the elephant bust shown in figure 4.2 is part of the wall and archway; it is structural. As a result, it is not signage, or any other type of street furniture.
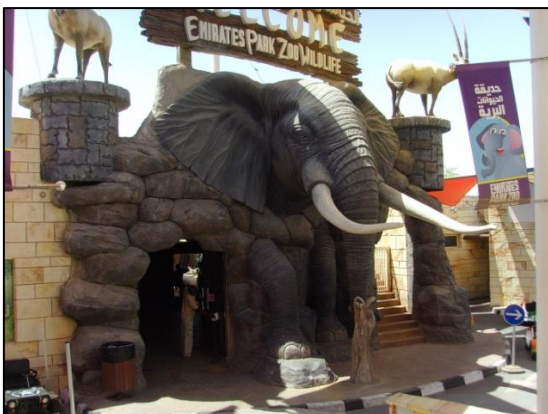
Figure 4.2: Animal-themed archway

Four case studies sites were chosen for this thesis. The selections represent literal replication, described by Groat (2013) as sites that are logically chosen to predict similar results and convergent evidence. This is fitting given that multiple case studies should seek to establish homogenous cases, for the purposes of direct comparison concerning extant theory (Gerring, 2007). The concept extends to data collection and analysis, which should be replicated across the selected sites (Tayie, 2005). The Welsh Mountain Zoo, Chester Zoo, Edinburgh Zoo, and Belfast Zoo are the case study sites[3].

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[3] The only observed regional difference in street furniture provision was the use of the Welsh language on signage at the Welsh Mountain Zoo. Further information on this topic is provided in section 6.3.1.

Beyond the fact that all case study sites are zoological gardens, site selection was not arbitrary. Firstly, it was sensible to conduct the study only in the United Kingdom. This helped to limit cost and time availability problems that would have been associated with travelling abroad. More importantly in research terms, it placed geographical boundaries on the study, which increased the likelihood of establishing generalisable results and viable claims. These boundaries ensured that data availability was sufficient. Had a study of zoological street furniture accessibility been conducted exclusively in Wales, rather than the whole United Kingdom, data availability would have been lacking. As a result, the logic of the design would not have related to the studies aim.

It was also logical to limit this study to the United Kingdom due to the high number of zoological gardens within this location. Zoological gardens are defined as *'any establishment where animals of wild species are exhibited to the public. Circuses and pet shops are excluded from this definition' (Department for Environment, Food and Rural Affairs, 2012: 5)*. Consequently, data availability was plentiful, without the need to expand the boundaries of the study further to increase the total population from which the sites were selected. Doing so would have made the data overwhelming. The British and Irish Association of Zoos and Aquariums (2015a) lists over 100 members in the United Kingdom, all of which are represented by the formal definition for a zoological garden.

To ensure that the whole United Kingdom was represented, one site from each country was selected. Supported by data provided by Sheridan (2011), selection was based upon each site being the most visited in their respective country. This stipulation ensured that the sites housed enough street furniture to warrant data collection, based on the assumption that larger sites are generally more popular. It was important to select the United Kingdom's most popular zoological gardens, as had they been ignored this would have posed questions regarding unusual case study site selection. This issue would have been particularly apparent had Chester Zoo not been selected as a case study site. Chester Zoo is the most visited zoological garden in the United Kingdom (Association of Leading Visitor Attractions, 2015). Its importance and relevance to the zoological community as a whole influences the importance and relevance of this thesis, due to its inclusion.

The case selection criteria detailed here is representative of non-probabilistic sampling. Merriam (2009) states that researchers utilise this sampling technique when they wish to gain specific insights, and therefore select cases that are most likely to fulfil this objective as they are information rich. Conversely, probabilistic sampling is essentially random within a defined framework (Newby, 2014), for example, arbitrarily selecting any four zoological gardens in the world to explore zoological street furniture accessibility. Probabilistic sampling is typically used when dealing with statistical data (Merriam, 2009); thus, it would not have been useful for this thesis. Site selection, under the umbrella term non-probabilistic sampling, can be more accurately described as criterion sampling. This technique involves selection based upon a predetermined set of criteria (Fletcher and Plakoyiannaki, 2011). In this instance, site selection can be summarised by the following statement; each case study site is the most visited zoological garden in each of the four countries that make up the United Kingdom.

Irrespective of arguments regarding economic culpability, there is still an ethical case for contextually aware inclusive design in both publically and privately owned zoological gardens. Therefore, differences in ownership were not taken into account when considering site selection. All case study sites, with the exception of Belfast Zoo, are charitable zoological societies (independent). Belfast Zoo is a direct municipal. In the United Kingdom, around 90% of zoological gardens are private sector organisations (Sheridan, 2011). This is not the case the world over; in Germany, around 90% are part of the public sector (Sheridan, 2011). Potentially exclusionary factors such as differences in ticket prices, and how easy it is to access the sites by public transport were also not part of the site selection criteria. Like site ownership, these topics did not directly relate to the thesis aim.

The temporal boundaries of a study should be clearly established at the design stage (Yin, 2009), as these are typically less apparent than spatial equivalents (Gerring, 2007). Moreover, researchers are more likely to lose control of a project with no definitive time limit (Wield, 2002). In this instance, temporal boundaries are linked directly to academic conventions and cost limitations. Case study research took place between 2010 and 2015, as the author had to undertake part-time, rather than full-time study, due to a lack of funding. Part-time PhD study customarily takes place over a five-year period, with an additional two years for thesis production. Had there been more control

over this issue a shorter time period would have been preferable, as the likelihood of the thesis being outdated due to change would have been reduced. Despite the five-year temporal distinction, outdated information has not shown itself to be a key problem. Both the nature of inclusive design and zoological street furniture has remained largely consistent during this time.

Validity and reliability must both be established when designing case studies. Swanborn (2010) states that construct validity, internal validity, external validity, and reliability are the four tests of quality, which ensure that the empirical research that binds a case study is well founded. Construct validity ensures that data collection procedures produce valid measurements to meet research aims and objectives (Swanborn, 2010). Recording the unique nature of zoological street furniture accessibility has allowed for an evaluation of the effectiveness of an inclusive design analysis; suggesting that it is context dependant. Although the latter is of primary importance, it is entirely reliant upon the former process, as it is impossible to judge an inclusive design analysis without conducting one. Construct validity is therefore focused upon how successfully research procedures capture the unique nature of zoological street furniture accessibility. The specifics of how each research method contributes to thesis construct validity are discussed as part of separate sections dedicated to each method, later in this chapter. Photography, interviews, and experiments have all been used, which is appropriate, as Yin (2009) suggests referencing multiple sources of evidence to bolster construct validity.

The second test, internal validity, implies confidence in causal relationships, through a process of eliminating rival explanations (Yin, 2009). In general, case study research is associated with high levels of internal validity, due to its ability to document reality, based upon in-depth study within a natural context (Gagnon, 2010). Yet, internal validity is a particular concern regarding explanatory studies, which seek to establish causality (Yin, 2009). Within this thesis, the dominant claim is that the effectiveness of an inclusive design analysis is context dependant; hence domain-specific access issues should be taken into account when seeking to increase accessibility. A further claim is that zoological street furniture accessibility is unique. With reference to internal validity, and prior to presenting evidence in favour of these claims, an opposing intellectual position is discussed in detail to dispel what is a converse rival explanation.

The potential rival claim is that an inclusive design analysis is not context dependant, as zoological street furniture is not unique.

The third test, external validity, is particularly relevant to this research, as it influences the weighting of generalisations to targeted domains (Swanborn, 2010). For this thesis, an inherent claim is that domain-specific access issues influence the effectiveness of inclusive design, not just at the four case study sites, but also for all United Kingdom zoological gardens, and possibly in other institutional settings. Consequently, research findings help to develop a heightened understanding of inclusive design, with broad implications. This argument is based upon replication logic across four studies, which is significant as Yin (2009) argues that for case study research, external validity is strengthened by literal replication. Had a single case study been undertaken the argument for external validity would have been extremely weak. Single case studies are commonly only undertaken when the subject being analysed is extreme or critical (Blaikie, 2010). If a subject being studied cannot be categorised in this manner and only a singular study were undertaken, it would be reasonable to expect criticisms in relation to external validity: *'propositional breadth and evidentiary breadth generally go hand in hand' (Gerring, 2007: 49).*

Greene (2011) states that for interpretivist researchers, all forms of validity relate to credibility, which is defined as a sufficient illustration of a studied social reality (Curtis, Murphy, and Shields, 2014). Research findings offer validity if they are found to be logical and meaningful, given their context of application (Greene, 2011). With this in mind, it can be argued that inclusive design research is inherently meaningful, while the structure of a conventional academic thesis is inherently logical. Approaches to enhancing the validity of interpretivist study include prolonged engagement with a topical focus, and having other relevant parties check over findings (Curtis *et al*, 2014). For this thesis, the combined length and level of study has ensured prolonged engagement, while interviewees have reviewed and provided feedback on research findings.

Reliability is the final test. In academic research terms, the concept assesses the likelihood that research results could be reproduced by a parallel investigator (Bryman, 2012). However, when working within an interpretivist framework this is not a desired

goal, as researchers accept and explain subjectivity, rather than seek to eradicate it (Weber, 2004). Another academic undertaking this research would not only require a detailed understanding of inclusive design, but also a passion for the subject area. Even if this were the case, the final narrative and conclusions would naturally be different. Yin (2009) advises that case study researchers document their process in a detailed manner to support reliability claims. This chapter and all of the subsequent chapters detail what has occurred, to increase reliability, as do the thesis appendices.

4.3.3 Prepare

The third stage of case study research, as detailed by Yin (2009), refers to preparation. The same author states that a key part of this process relates to the knowledge of the individual researcher concerning their area of study. Due to related MA study and the thesis literature review, the author's knowledge of inclusive design, zoological gardens, and street furniture is confirmed. Yin (2009) states that the interaction and relationship between underpinning theory, context, and data collection in case study research justifies this preparatory need. To illustrate this point, in can be stated that without knowledge of applicable access issues from current literature, it would not have been possible to conduct an inclusive design analysis.

Yin (2009) suggests undertaking a pilot case as part of case study research preparation. This he states can be geographically opportune or represent a complex case that is likely to highlight as many of the issues and topics as possible that will be encountered in the subsequent studies. The author, as part of his MA study, conducted a review of Chester Zoo's site accessibility (Richards, 2009) and this can be thought of as the pilot case for this thesis. As the author resides in Chester and Chester Zoo is the most popular zoological garden in the United Kingdom (Rees, 2011), the site is aligned with both of the aforementioned criteria for a pilot case. The realisation as an MA student that this topic would benefit from far more investigation, as it was poorly documented in literature, was a major influence upon this thesis. It is during this time that it was first observed, without a comprehensive evidence base, that the zoological domain presented very specific access issues; hence, context influences the effectiveness of an inclusive design analysis.

Figure 4.3 shows an original photograph from the MA case study, which offers an example of how zoological street furniture is different to street furniture elsewhere and therefore access to information issues are also different, due to the presence of captive animals. At this point, the research was broader. Initially, an argument had not been formulated to explain why focus should be placed upon street furniture. Research focused upon general access issues, including street furniture, whereas thesis content evidently focuses exclusively upon street furniture. The notion of exploring a broader issue as a pilot case, to focus upon a more specific one that references a knowledge gap, at a later date, is promoted by Yin (2009).

Figure 4.3: Directional signage for multiple species

An additional preparatory task for this thesis was to arrange access to the four case study sites. Part of preparing for case study research is to develop relationships with relevant people and organisations (Corwin and Clemens, 2012). Accordingly, a letter of introduction was sent to each chosen zoological garden. The letters included an overview of the research agenda, alongside a request to conduct on-site research. As a member of the public and a paying customer, the author was able to gain access to any of the elected sites to photograph street furniture. Nevertheless, a formal introduction helped to develop a relationship with the four organisations and specific individuals, which assisted with arranging interviews and on-site experiments. Following receipt of the initial letters, all of the case study sites requested that a research project agreement be completed. Appendix 1 offers the Welsh Mountain Zoo's form as an example. Consequently, these requests were met and research access was granted for all four sites.

Access to each zoological garden was ultimately granted by a gatekeeper. In academic terms, a gatekeeper is someone who can permit or prevent access for research purposes (Jennings, 2005). For the Welsh Mountain Zoo this was the organisation's director, Nick Jackson. At Chester Zoo, access was granted by an administrative staff member, while at both Edinburgh Zoo and Belfast Zoo education officers functioned as gatekeepers. In some cases, a gatekeeper can assist with the research process, offering guidance or insight, such as advice on who to speak to or where best to find information (Jensen, 2008). This was indeed true of Nick Jackson, who took part in the research process as an interviewee.

Prior to data collection, a case study protocol was devised to document explicit and systematic data collection procedures to be used once on site at the four zoological gardens. Producing a case study protocol facilitates and promotes transparency and replication, by specifying how research will be undertaken (Gibbert, Ruigrok, and Wicki, 2008). It is also seen to increase the consistency and thus the reliability of case study research by focusing researcher attention on the central aim of a study (Yin, 2009). The following information should be included:

- *An overview of the case study project*
- *Field procedures, such as use of different sources of information, and access arrangements to these sources*
- *Case study questions, or the questions that the case study researcher needs to keep in mind when collecting data*

(Rowley, 2002: 22)

The case study protocol for this thesis is presented here in diagrammatic form (figure 4.4). Regarding the aforementioned guidance by Rowley (2002), a research overview is provided alongside detail on field procedures. Due to the nature of the research, the thesis aim, rather than a specific research question, served as a central guide to data collection. The case study protocol is based solely upon documenting zoological street furniture using photography, as this process preceded all others (interviews and experiments). As a result, it focuses exclusively upon explaining the unique nature of zoological street furniture accessibility in the United Kingdom through photography. Evaluating the effectiveness of inclusive design as an analytical tool could only take place following this explanation; accordingly, the protocol prioritised this initial stage in the process.

Case
- Case study research is to be conducted at four United Kingdom zoological gardens to explain the unique nature of zoological street furniture accessibility in the United Kingdom. The sites in question are the Welsh Mountain Zoo, Chester Zoo, Edinburgh Zoo, and Belfast Zoo.

Study
- The process is led by documenting zoological street furniture at each case study site using photography. Official access to conduct research must be granted by each zoological garden prior to arrival at any of the case study sites.

Protocol
- A camera and writing materials should be taken on each site visit and the date and location of each photograph must be recorded. Photographs should reflect the artefacts in their natural state; as they are found, without any form of intervention.

Figure 4.4: Case study protocol

4.3.4 Collect

Site visits were spread over a three-year period. The Welsh Mountain Zoo was visited on the 19th of November 2010, Chester Zoo was visited on the 27th of March 2012, Edinburgh Zoo was visited on the 16th of October 2012, and finally, the Belfast Zoo site visit took place on the 27th of February 2013. Ideally, these visits would have taken place over a shorter period of time, to increase the external validity of subsequent

coding *vis-à-vis* temporal decay; however, this was not possible due to the nature of part-time study. The spread of the site visits meant weather conditions varied during data collection. Nevertheless, weather itself did not influence the data collection process, in terms of documenting zoological street furniture accessibility.

Case study data collection relates to six primary sources of information, which are listed as *'documents, records, interviews, detached observation, participant-observation, and physical artefacts' (Gillham, 2000: 21)*. It should be noted that this list is not exhaustive, with Wiebe (2010) stating that photographs, for example, can be a useful source of information. Proverbs and Gameson (2008), taking the argument further, suggest that all forms of evidence are useful when undertaking case study research. How relevant each source is will of course vary, depending upon project specifics (Neale *et al*, 2006). The manner in which different sources have been used collectively is the main focus of this section.

Numerous documents and records have been referenced throughout this thesis. For the most part these have been academic texts and journal articles, although email correspondence has also been used. For instance, the Welsh Mountain Zoo provided visitor statistics via email, which were used when determining sample sizes for the first case study experiment. Proverbs and Gameson (2008) advocate the use of internal documents and records such as this, to gain specific insights regarding case study sites, which subsequently facilitate further study. All documents and records have been critically analysed and then utilised in relation to the thesis research aim. Despite the potential for bias, Yin (2009) notes that the advantage of documents as a source of information is that they typically contain exact data that has rarely been created as a result of the case studies being undertaken, thus inherent bias directly favouring the investigator is very unlikely.

Due to the importance of conducting interviews for this thesis, a separate section is dedicated to this topic (see section 4.4.2). It is however worth exploring here how the topic relates to case study research. Yin (2009) argues that interviews are an essential component of case study research, due to their ability to focus upon human affairs and behavioural events. In support of this, Seidman (2006) states that qualitative interviews can be used successfully in combination with other approaches to conducting research.

Yin (2009) also states that when conducting case study research structured interviews should preferably not be used, as these are not aligned with the fluid nature of the methodology. Structured interviews are those that use only predetermined questions (Haigh, 2008). Semi-structured interviews focus upon fixed areas of interest through the use of both predetermined and spontaneously fashioned questions (Gillham, 2005). A final category, unstructured interviews, can be conducted without any predetermined questions, using only a broad topic for discussion (Myers, 2013). This thesis only utilises semi-structured interviews. The expertise of the chosen interviewees and the complexity of the topic justified the use of semi-structured interviews. For case study research, interviews should capture the opinions of key persons whom can offer relevant in-depth perspectives (Proverbs and Gameson, 2008). All interviewees selected for this thesis were able to make a contribution of this nature.

Photography was utilised as the primary source of data collection due to the visual nature of the unit of analysis. Documenting the accessibility of zoological street furniture through the use of photography can be categorised as detached observation, participant observation and a record of physical artefacts. Detached observation refers to studying a phenomenon from an uninvolved perspective and usually involves classification and documentation (Gillham, 2000). Employing detached observation is typically associated with unbiased and accurate data (Proverbs and Gameson, 2008). At the time of writing, the author has not been previously employed by a zoological garden, therefore the observation undertaken can be categorised in this way. Conversely, participant observation involves an active role at the case study sites being investigated (Gagnon, 2010). As the author was a customer and had been approved to conduct on-site research by the four zoological gardens, the observations can also be categorised in this manner. As a result, detached observation and participant observation were undertaken. The combination of both approaches is advocated by Gillham (2000) who claims that together they can be used to reveal more than when used in isolation. From a detached perspective, data collection was guided not by an involvement with the sites, but by the thesis research aim. Equally, being a long-standing customer of zoological gardens in general and thus understanding what to expect on-site, informed the data collection process in terms of participant observation. Clearly, the aforementioned process also relates to physical artefacts as a source of information; all photographs were of physical items of street furniture. To provide further detail on this

discussion, a separate section is dedicated to the use of photography as a research method (4.4.1).

Working collaboratively when undertaking research can enhance creativity and enjoyment, yet it presents associated challenges in terms of time management and division of labour (Fox and Caruana, 2012). Despite the influence of multiple sources of evidence, data collection for this thesis represents the work of one author. Evers and van Staa (2010) recommend that when conducting case study observations it is useful to have more than one investigator repeat the process to increase accuracy. While it can be argued that this is less of a concern from an interpretivist theoretical perspective, which places value upon individual perceptions, funding restrictions dictated the use of only one investigator. Had more time and money been available, adding another informed perspective during data collection would have no doubt been revealing.

4.3.5 Analyse

Prior to conducting case study analysis Yin (2009) recommends making use of at least one general analytic strategy to guide the subsequent analysis. He lists three customary approaches, which are relevant to this thesis: relying on theoretical propositions, developing a case description, and using both qualitative and quantitative data. This section addresses all three of these in succession. The first strategy, relying on theoretical propositions, is highly significant. The thesis research aim is to evaluate the effectiveness of inclusive design as an analytical tool and to explain the unique nature of zoological street furniture accessibility in the United Kingdom. The data analysis is subsequently guided and organised by this aim and the associated theoretical proposition that an inclusive design analysis is challenging and context dependant. The idea that context influences the applicability of inclusive design guides the analysis, in terms of which data points to explore in greater detail to substantiate the core thesis argument. Furthermore, the notion that zoological street furniture is unique also guides the analysis, while subsequently underpinning the argument that milieu can impinge on the value of accessibility guidance. Theoretical propositions focus a studies scope, thus increasing the likelihood of successful completion (Baxter and Jack, 2008).

Even when a case study is itself not simply descriptive Yin (2009) states that developing a case description can be useful prior to data analysis. The process involves designing a framework for analysis, or typology, to aid organisation. For this thesis, street furniture was categorised by type prior to data analysis to create a manageable and ordered process. Seating, litter bins, and signage are the three categories in question, as it was initially evident that zoological street furniture predominately related to one of these three key categories. Other categories were emergent and are discussed further in the photography data analysis section (4.4.1.4). Developing a case description is comparable to compiling a case study database. Swanborn (2010) states that once data collection is complete and prior to any data analysis, a case study database should be compiled using logical categories. Not only does this assist with the subsequent process of data analysis, by refamiliarising researchers with their data (Yin, 2011), but it also means that the database can then be the subject of future analysis by other researchers (Swanborn, 2010). All of the photographs from the four case study sites are included as a digital appendix on the inside face of the thesis back cover, for interested parties to peruse. Davis (2010) recommends providing an entire case study database, to allow for independent inspection of raw data, which in turn increases reliability.

The third analytic strategy, using both qualitative and quantitative data, relates directly to thesis content. Qualitative research focuses upon describing characteristics, without reference to specific measurements, while quantitative research is standardised, objective, and directly reliant upon numeric measurements and amounts (Thomas, 2003). Hulme (2007), states that when both qualitative and quantitative data is synthesised, the overall quality and reliability of analysis can be improved. He explains that qualitative data often explores social context in a detailed manner, while quantitative findings typically offer more persuasive generalisations; however when combined, a deeper understanding can be gained compared to the use of one approach in isolation. Interviews, which offer qualitative data and experiments, which offer both qualitative and quantitative data, are mutually referenced in this thesis, to increase reliability. Case study research typically references both qualitative and quantitative data, although qualitative findings should be the focus, due to the methodologies ability to explore social contexts (Brewerton and Millward, 2001); therefore, this approach has been taken and is evident throughout. Quantitative data is presented only to support

qualitative findings. Consequently, the data analysis strategy is principally guided by qualitative findings, not qualitative and quantitative data in equal measure.

This section has focused upon a series of analytic strategies, rather than actual data analysis techniques. Separate sections detail how photographic data, interviewee feedback, and experiment results have been analysed, later in this chapter. Cross-case synthesis and qualitative content analysis have been employed to analyse photographs, interviews were subject to a process of analysing thematic connections, and directed content analysis was applied to qualitative experiment results. Quantitative experiment data was analysed using a series of Chi-Square tests.

4.3.6 Share

Case study findings are shared from two distinct intellectual positions, allowing two opposing arguments to be formed. The first explains why standard inclusive design guidance can be applied directly to a zoological context, suggesting that the effectiveness of an inclusive design analysis is not context dependant, nor are the accessibility issues surrounding zoological street furniture unique. This argument only serves however as a precursor to a subsequent and more compelling and detailed alternative. The second argument highlights the unique nature of zoological street furniture accessibility and in doing so, evidences the influence of context upon the effectiveness of inclusive design as an analytical tool, challenging current orthodoxy. The manner in which findings are reported represents an argumentative plus analytic organisational structure, based upon guidance by Dunleavy (2003) on how to structure an academic thesis. This section discusses his guidance to explain how case study findings have been reported.

Dunleavy (2003) suggests using an augmentative structure to present two opposing viewpoints or intellectual positions, with the first being the least convincing and detailed of the two. The ordering process derived from this technique is, antithesis, thesis, and then synthesis; after presenting conflicting viewpoints, both are discussed together in favour of the second, stronger argument. The same author states that when followed using clearly defined chapters, this approach allows for a well-organised and

unambiguous outcome, providing sharp focus concerning how a research aim has been addressed. It is also suggested that an academic thesis should not seek to establish more than two argumentative positions, as doing so impinges upon how intensively a topic is covered (Dunleavy, 2003). For this thesis, the top-level organising principle is the argumentative dimension, which means that it dictates the central focus of each chapter, rather than how individual chapter content is ordered.

The second-tier organising principle is the analytic dimension, used to order chapter content using component parts. To organise an argument analytically is to reduce complexity by forming logical categories, rather than ordering based on random external influences, such as temporal occurrence (Dunleavy, 2003). Selected categories should be simple and recognisable concepts that relate to a research aim, thus advancing an argument (Dunleavy, 2003). In the case of this thesis, simple and recognisable categories of street furniture are used to provide a comparable order and format for the two opposing intellectual positions. Existing inclusive design guidance is also used to provide a framework for discussion, regarding each street furniture category.

From a case study research perspective, the format chosen to report case study findings can be described as a comparative structure. Yin (2009) states that a comparative structure repeats and compares case study data, through more than one explanation of findings. An inherent advantage of this approach is that reviewing an opposing view in detail heightens credibility, by establishing which point of view is most accurate in relation to research findings (Yin, 2009).

All four zoological gardens are named directly when presenting both opposing intellectual positions. In terms of anonymity when reporting case study findings, Yin (2009) states that it is preferable to name sites and organisations, as this allows readers to conduct their own further investigation. For example, readers of this thesis can visit one of the four named organisations to view the street furniture, which has been analysed, unless it has since been removed. Had the street furniture been attributed to an unknown zoological garden in the United Kingdom this would not have been possible. Following submission, the author intends to share this thesis with all United Kingdom zoological gardens.

4.4 Methods

Research methods are planned and specific techniques or procedures used to gather data (Waring, 2012). They are principally determined by a studies question or aim (Waring, 2012) and encompass not only data collection, but also analysis and interpretation (Dainty, 2008). For this reason, they are inherently linked to prior epistemology, theoretical perspective, and methodology selection (Dainty, 2008). This section provides detail on how and why photography, interviews, and experiments were used to generate convergent evidence concerning the thesis research aim. These methods are reviewed sequentially, inclusive of sections discussing validity and reliability, research ethics, and data analysis.

4.4.1 Photography

Photography as a research method allows for in-depth empirical social inquiry, stemming from a cornucopia of existing photography and the potential for researchers to generate their own images (Stanczak, 2007). Utilising photographic data is appropriate, given that it is representative of and complements our increasingly visual culture (Holm, 2014). Indeed, the commonality of word-orientated research is a barrier to generating knowledge using imagery, which needs to be addressed by the academic community (Prosser, 2005). Depending upon the cost of the camera being used, photography is a relatively inexpensive and accessible research method (Fox and Caruana, 2012). In relation to the built environment, photographs naturally assist with the study of complex visual phenomena including artefacts, buildings, and environments (Tinkler, 2013). They allow for a heightened understanding of contemporary urban landscapes, by communicating visible qualities such as layout, colour, texture, form, volume, size, and pattern (Rose, 2012). A particularly compelling argument for the use of photography as a research method is that words alone are often an insufficient approach to communication (Prosser and Loxley, 2008). The position taken here is that this is the case for street furniture research. For this thesis, photography has been employed as the primary case study research method. Interview questions and experiment concepts have been derived from an initial process of photographic data collection and analysis, highlighting the central role of photography.

The theory that zoological street furniture accessibility is unique emerged from the photographic data; subsequently the theory that the effectiveness of an inclusive design analysis is curtailed by context, specifically the zoological context, emerged from the previously established uniqueness of zoological street furniture. Figure 4.5, from Blackpool Zoo, shows why the topic is unique, in relation to animal welfare.

Figure 4.5: Visitor behaviour sign

4.4.1.1 Procedure and Classification

Street furniture photographs were taken at all of the case study sites, employing the inclusive design research technique of self-observation; defined as a professional assessment of accessibility, which draws upon the expertise and experience of a single investigator (Cardoso, Keates, and Clarkson, 2005). Photographs later functioned as a series of *aide memoires* during data analysis. In relation to access audits, Ormerod (2005) recommends using photography to record access concerns, which can be reviewed later in an office environment. Figure 4.6 from Thrigby Hall Wildlife Gardens illustrates why and how photographs can record a level of detail that would be typically difficult to recall without a visual point of reference.

Figure 4.6: Lar gibbon (Hylobates lar) exhibit label

The process undertaken for this thesis can be described as photo-documentation, which occurs when researchers systematically generate images to analyse at a later date (Rose, 2012). In all instances the date and location of each photograph was recorded. A record of this information is particularly useful for future researchers to be able to establish a cultural framework when referring back to past research (Mietzner and Pilarczyk, 2005). Two cameras and one smartphone were used to take the case study photographs:

- Samsung Digimax i6 (Camera)
- Sony W690 (Camera)
- Sony Ericsson Xperia PLAY (Smartphone)

The street furniture photographs produced for this thesis can also be classified as documentary photography. Documentary photography has a specific purpose beyond any inherent aesthetic value; it attempts to convey a subject of importance (Bogre, 2012). In doing so, it is normally associated with social change and investigation (Bogre, 2012). For example, figure 4.7 is from a series of images by Britta Jaschinski, which question if it is right for animals to be confined. Concerning this thesis, using photography to conduct and evaluate the effectiveness of an inclusive design analysis represents a subject of importance regarding social change, specifically in the context of the needs and aspirations of older and disabled people.

Figure 4.7: Polar bear (Ursus maritimus) enclosure
Photography by Britta Jaschinski

Other relevant classifications include supplemental and supportive photography. Supplemental photography is usually presented without explanation, while supportive photography is explained using text in relation to a research aim or question (Tinkler, 2013). All of the photography presented as part of this thesis is supportive. It is utilised in relation to the thesis aim, alongside explanatory text, to enhance clarity and understanding, and to offer authentic visual evidence. For academic research purposes, it is customary for photographs to be supportive, particularly when documentary photography is employed (Tinkler, 2013).

4.4.1.2 Validity and Reliability

In relation to both construct validity and reliability, the author subscribes to a mild-realist approach to the use of photography in academic research. Mild-realists believe

that photographs can offer a level or sample of reality, yet they are subject to a complex process of construction, shaped by multiple influences (Tinkler, 2013). These range from the bias of the photographer, to the interpretation of the person analysing the photographic content. The mild-realist position is aligned with interpretivism, thus individual bias and interpretation are accepted as being intrinsically linked to the research process. Two opposing views are that of the naive-realist, who believes that photographs accurately depict reality without exception, and an anti-realist position, which claims that photographic data cannot accurately represent what people observe, due to the overbearing influence of personal interpretation and each individual production technique (Tinkler, 2013). Despite varying points of view, photographs are able to offer a precise and reliable data collection method, uninhibited by fading memory (Stanczak, 2007). Yet it must be acknowledged that all are influenced by a purpose or intended message, and personal interests, which are not always ostensive (Holm, 2014).

Although a mild-realist position is adopted, photographs of zoological street furniture taken by the author have been deemed to represent the case study unit of analysis with a high level of accuracy, as they were taken specifically for this thesis. In all instances, photographic practice has been exclusively guided by the thesis research aim. While the images are subjective, they provide a focused account. In addition, firsthand knowledge of the process of generating photographs has enhanced confidence in image credibility. This justification is supported by criticisms levied at archival photographs. Holm (2014) notes that most photographs from an archive are anonymised, thus the intentions of the photographer and contextual factors are unknown. Confidence is also derived from the social simplicity of street furniture. When photographing people, for instance, the presence of a camera may influence behavioural changes (Gray, 2014), but this is not the case for street furniture. Its inert form alone cannot act in a spontaneous or contrived manner, at the point at which a photograph is taken.

With regards to internal and external validity, it is important to state that all street furniture photographs were taken without any form of intervention. None of the photographs infer anything inauthentic, enhancing internal validity. For example, signs were not cleaned prior to being photographed. Intervention in this context relates to typicality (Tinkler, 2013). As all images are presented alongside detailed explanatory

text, typicality and correlated external validity are both discussed, in terms of how many case study sites housed comparable items of street furniture. Providing contextual detail, such as this, allows photographs to contribute towards external validity (Adelman, 2005).

Prosser (2005) states that for many orthodox qualitative researchers, the transitory nature of photography is perceived as a threat to construct validity. He explains that compared to filmmaking, photography typically captures only one sixteenth of a second worth of data, while the length of filmmaking normally offers far greater contextual data, through movement and speech. To alleviate this validity threat, Prosser (2005) suggests that researchers present multiple photographs, alongside contextual narrative. This advice has been heeded and is evidenced throughout thesis output.

With digital photography, there is a heightened potential for image manipulation distorting depictions of reality (Hofer and Swan, 2005). When this takes place, the integrity of research is challenged, as photography can be seen to deceive or mislead (Goldstein, 2007). Image manipulation concerns link most pertinently to construct validity and reliability. Editing of case study images has been limited, despite the fact that all the photographs are digital. For some of the images cropping has been undertaken. This has been done to draw attention to significant access issues, increasing clarity for the reader. In relation to cropping, Goldstein (2007) argues that such a process always takes place, yet more typically at a temporal rather than a spatial level. He explains that the process of image creation involves cropping from the outset, when photographers point their camera, thus disparaging the post-acquisition cropping process is often nonsensical. The opposing view is that cropping reduces the contextual frame of reference (Banks, 2001). In summary, while photographs can be polysemous or mendacious, they generally offer accuracy in academic output, and this is certainly the case for this thesis. Ultimately, authenticity is determined by the honesty of the photographer.

4.4.1.3 Ethics

Due to the strictly inanimate nature of street furniture, many customary ethical concerns have not been relevant when generating case study photographs. Informed consent and

anonymity should both be taken into consideration when images of people form part of research output (Holm, 2014). When using photography as a research method informed consent refers to permission to produce and publish images, which is understood and given freely (Wiles, Coffey, Robinson, and Heath, 2012). Within this context anonymity ensures that identity is not disclosed (Stokes, 2011), something typically impossible to guarantee when dealing with visual data (Wiles *et al*, 2012). Even small details within an image, such as an item of clothing, may reveal someone's identity (Holm, 2014). However, as there are no images of people presented within this thesis, issues regarding informed consent and anonymity for photographs are largely immaterial.

None of the thesis photographs include children, or evidence of any criminal activity. Equally, none of the images included promote any form of discrimination or present people in an undignified manner. All of these types of photographs present specific ethical concerns (Tinkler, 2013), not relevant in this instance, despite their obvious importance. Issues surrounding covert photography, such as an inability to obtain informed consent or elicit personal opinion (Collins, 2010), are also not applicable, when generating street furniture photography.

A final ethical concern when using photography as a research method is reputational harm (Wiles *et al*, 2012). Photographs of inaccessible street furniture, for example, can reflect poorly upon the locations in which they are found, or are claimed to be found. This presents a relevant concern with regards to harm, in that they can damage the reputation of an organisation. It is important therefore to consider if photographic data is generally representative or if it illustrates an exception to the rule. Supportive narrative can address the need for clarification. Photographs presented within this thesis serve a sole purpose regarding the research aim; consequently, reputational harm is admittedly a secondary concern. While there has been no intention to damage the reputation of any specific zoological garden through research output, a resultant message that accessibility is subpar only serves to highlight further the need for inclusive design, and as a result the need to better understand the application of inclusive design as an analytical tool.

4.4.1.4 Data Analysis

Tinkler (2013) stresses that when academics analyse photographs the process is unavoidably informed by their existing knowledge, ranging from understanding derived from literature to personal memories and experiences. The process of analysis is a reflexive interpretation, which moves beyond the boundaries of literal meaning (Schulze, 2007). For figure 4.8 literal meaning determines that the photograph depicts an outdoor sign displaying the single word 'peccary', and that it is extremely likely that this is a zoological garden sign due to the visual information on display and the lack of other possibilities, considering all species of peccary are mammals native to the Americas. It is also apparent that the photograph was taken during daylight hours. Conversely, a reflexive interpretation, guided by inclusive design philosophy, is that Dudley Zoo has failed to consider the needs of those people who do not understand the word 'peccary', as no supporting imagery is displayed on the sign. Although the fact that there is no image on the sign could be understood through a critique of the literal meaning, a criticism of why this is an important omission cannot be understood from the picture in isolation, but rather from an independent perspective. The sign connotes a lack of accessibility. For this thesis, photographs have been analysed by employing an openly subjective inclusive design interpretation, rather than by documenting only the literal meaning of the pictures. In support of this approach, research conducted by Schulze (2007) suggests that the intrinsic meaning of a photograph can only be explored through individual interpretation.
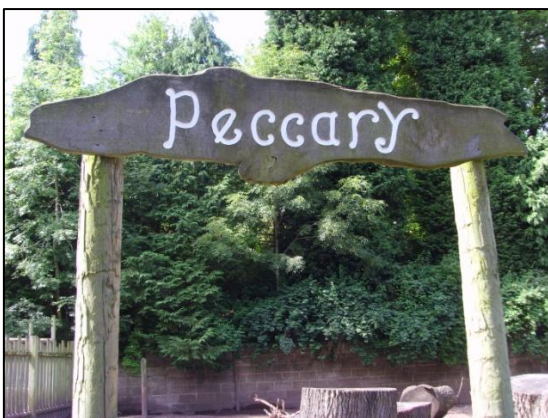
Figure 4.8: White-lipped peccary (Tayassu pecari) identification sign

Photographic data analysis began with an examination of the current state of zoological street furniture. This involved confirming what constituted zoological street furniture by finding out how it was different to street furniture elsewhere, using cross-case synthesis as an analytic technique. Yin (2009) advocates the use of cross-case synthesis for multiple case studies, and describes the process as the utilisation and examination of parallel data, from more than one case, to draw cross-case conclusions about a specific domain. For instance, all four case study sites housed feeding restriction signs. As this sign type does not exist in a typical street environment, yet did exist at all of the case study sites, feeding restriction signs were confirmed as domain-specific using replication logic. Subsequently this topic and others like it were analysed in terms of inclusive design to explain the unique nature of zoological street furniture accessibility in the United Kingdom. Undertaking this process allowed for an evaluation of the effectiveness of inclusive design as an analytical tool; resulting in the substantiated claim that the process is context dependant.

The process of cross-case synthesis can also be discussed in terms of qualitative content analysis, which involves coding photographic data in relation to subjective constructed meaning, warranting interpretation (Holm, 2010). Categories or codes can be preselected or alternatively they emerge out of contextual data, due to frequency and relevance (Roller and Lavrakas, 2015). Once codes have been determined and photographs allocated to a specific code, the results must be interpreted (Schreier, 2012). Researchers must specify the interpretation value for the latter stage of qualitative content analysis, as the coding process itself does not determine the research focus (Schreier, 2012). In the case of this thesis, codes are used to explain the unique nature of zoological street furniture. Relevance to context, rather than frequency, was the primary consideration in all instances when coding data. Thereafter a theoretically informed inclusive design analysis took place to explain these topics in relation to accessibility. The analysis was based upon design guidance for accessible street furniture from current literature, previously established as part of the thesis literature review (Chapter 3). Conducting the analysis has allowed the effectiveness of inclusive design as an analytical tool to be evaluated, by demonstrating the significance of contextual fit.

Figure 4.9 (from the Welsh Mountain Zoo) presents an illustration of a code, which emerged from the data; species distribution maps. The image shows distribution for the Andean condor (*Vultur gryphus*), which is found in Venezuela, Chile, and Argentina amongst other South American countries. Regarding qualitative content analysis, all exhibit label photographs were initially grouped together, however once it became apparent that not all of these displayed maps, a new code had to be formed; species distribution maps.

Figure 4.9: Andean condor (Vultur gryphus) exhibit label

4.4.2 Interviews

In-depth qualitative interviews are an influential research method, as they allow close access to complex social issues and take advantage of the ability people have to verbalise key topics (Seidman, 2006). Concerning the research aim for this thesis, they can provide an understanding of the relationship between phenomenon and context, by exploring culturally bound interpretations of reality (Miller and Glassner, 2011). Conducting interviews, as opposed to surveys, allows participant responses to be probed and clarified, generating greater levels of detail, accuracy, and quality (Yelding and Cassim, 2007), as well as being more engaging for participants (Anderson and Arsenault, 2002). In addition, qualitative interviews allow people to express themselves naturally, using colloquialisms, for instance (Hammersley, 2013). This in turn facilitates an exploration of *'opinions, values, motivations, recollections, experiences, and feelings' (Tayie, 2005: 98).* Qualitative interviews are illuminating, presenting far more compelling narrative than characterless quantitative data (Gillham, 2005). These arguments illustrate why interviews were utilised for this thesis. This section presents

detailed discussion to justify further the use of interviews as a research method, alongside information on how they have been used.

Traditionally, interviews have been seen as a fundamental property of much inclusive design research (Dong *et al*, 2007). Considering the opinions of others is a process that is instinctively aligned with inclusive design philosophy, as designing for as many end users as possible requires an understanding of divergent points of view, needs, and aspirations. This statement is supported by notable research undertaken by Ormerod, Newton, MacLennan, Faruk, Thies, Kenney, Howard, and Nester (2014), who used semi-structured interviews to explore the opinions of older people regarding tactile paving. Using interviews allowed for revealing inclusive design insights and an enhanced level of detail. Participant feedback revealed that flat tactile paving is especially important for older people, who are typically worried about falling when paving is sloped. Gathering this kind of feedback would have been impossible had the process been reliant upon pre-determined categories which had not referred to falling, and which had been imposed upon the participants by the researchers.

4.4.2.1 Procedure and Classification

Despite their idiosyncratic differences, all of the research interviews that have been undertaken can be categorised as semi-structured. As inclusive design relates to human interactions, a structured format would not have allowed for a sufficiently complex exploration, yet some degree of focus was required as the interviews were conducted for academic research purposes, relating to a specific aim. Lodico, Spaulding, and Voegtle (2010) discuss the benefits of this approach as it allows for focus, without overly perspective and programmatic constraints. Researchers use set questions or themes, although they can deviate to explore linked topics as and when appropriate (Gray, 2014). Doing so allows answers to be explored in greater detail (Mitchell and Jolley, 2013), and permits insightful two-way interaction (Yin, 2011).

Seven research interviews were conducted in total. Each case study site was the subject of two interviews, apart from Belfast Zoo, which was only discussed with one interviewee. The first five interviews utilised open-ended questions, which were given

to participants in advance of the interviews taking place[4]. During the course of this process, it became apparent that an alternate approach should be used, due to the visual nature of zoological street furniture and the fact that interviewees would physically point towards images to aid discussion. This prompted the author to utilise photo elicitation for the final two interviews. With hindsight, all interviews should have utilised photo elicitation; described simply by Harper (2002), who states that the technique involves using photographs as a tool during research interviews. When employing this technique, interview questions were not needed. Instead, interviewees were shown photographs of zoological street furniture to generate discussion concerning the thesis research aim. To offer a comparative example, Yates-Bolton, Yates, Williamson, Newton, and Codinhoto (2012) utilised photographs in their research to help participants (including people living with dementia, carers, practitioners and designers) discuss the accessibility of hospital environments for people living with dementia. The author was a participant in this research and was subsequently influenced by their approach towards generating data.

A number of key advantages support the use of photo elicitation. Firstly, this approach reduces pressure on both interviewer and interviewee, as the photographs act as a neutral third party (Clark-Ibáñez, 2004). Secondly, visual prompts can focus and stimulate memory, especially of earlier experiences or environments, more effectively than traditional interview questions (Harper, 2002). The research approach taken for this thesis found both these points to be true. A final advantage is that photo elicitation interviews overcome linguistic barriers (Clark-Ibáñez, 2004). While this was not a relevant concern for the case study interviews, it is an advantage aligned with a holistic approach to conducting inclusive design research.

The research process involved only one face-to-face interview with each of the participants, due to time and funding restrictions. Given the topical focus, single interviews served to elicit a great deal of relevant feedback and it is likely that repeating a similar process with the same individuals would have provided a diminishing return in terms of knowledge creation. It is nevertheless acknowledged that conducting multiple

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[4] Appendix 2 provides the list of questions from the interview with Peter Litherland. The questions refer to a draft report on the Welsh Mountain Zoo's street furniture accessibility. Similar questions were used for all of the other interviews; except the final two, which relied solely upon photo elicitation as opposed to traditional questioning.

interviews with the same participant can help to gather cumulative data and establish internal consistency, and that a previous interview can act as a foundation for subsequent meetings (Seidman, 2006). Ideally, multiple interviews with single participants would have been conducted based on the aforementioned rationale.

All interviewees were advised that discussions would last approximately one hour. Most did, however, some of the interviews lasted more than two hours, but those taking part showed no signs of wanting to cease proceedings and were asked if they were happy to continue. In all instances, interviews naturally concluded, rather than ending due to an arbitrary time constraint. Although Seidman (2006) states that continuing with an interview over an allotted time can result in interviewees losing faith in a researcher's ability to control proceedings, it would have been counterproductive and procrustean to stop the interviews simply because they had lasted longer than expected. In fact, participants who wanted to continue discussing accessibility were typically the most revealing and enthusiastic about the topic.

A specific number of participants to be interviewed were not established at the outset; rather the final number represents an emergent design. This is described by Morgan (2008) as allowing data collection techniques to evolve due to what has been learnt. Once seven interviews had been undertaken a sufficient amount of data had been collected. As noted by Rowley (2012), the number of interviews needed is solely determined by a studies question or aim. Nevertheless, given additional time and funding, conducting more interviews would have undoubtedly been revealing.

With specific reference to inclusive design, Asmervik (2009) recommends conducting interviews to gain a deeper understanding of contextually grounded accessibility concerns, but only after initial on-site research has been conducted. He explains that this allows for penetrating questioning to be developed that links directly to site-specific concerns. For this thesis, in all instances, case study interviews were conducted after spending time at each zoological garden, thus the interview process was based upon knowledge of the on-site street furniture.

4.4.2.2 Validity and Reliability

It is accepted from an interpretivist theoretical perspective that during the interviews the author influenced the responses provided and as a result the construct validity of the interviews; a conscious effort was however made to allow the participants to provide their points of view prior to open discussion between both parties. When conducting qualitative interviews the researcher is an active instrument used to gather and interpret data, consequently meaning and mutual understanding is formed due to a malleable interaction between interviewer and interviewee (Yin, 2011). Each interview dialogue is therefore unique. In addition, due to the topical focus and the nature of the participants, responses given were very likely to be true; in general, the interviewees had little reason to provide false statements.

In terms of external validity, as seven experts were interviewed, this presents more rigorous findings than had only one or two people taken part. This is because comments can be checked against the broader discourse of other participants (Seidman, 2006). In some instances, conducting only one research interview is permissible. This is the case when a participant offers insights that are not comparable, or when establishing process feasibility (Baker and Edwards, 2012).

Had another researcher interviewed the seven participants, as well as the author, this would have increased the reliability of the process. This however was not practical. Klenke (2008) suggests that when this is not possible both the researcher and another academic should look for themes in interview content and then compare results and interpretations, before writing up interview findings. The author's academic supervisor, Professor Marcus Ormerod, offered supplementary guidance in this regard.

4.4.2.3 Participants

Criterion sampling, which is based upon predetermined criteria (Struwig and Stead, 2007), informed the selection of the case study interviewees. This approach is appropriate for in-depth interviewing, as participant expertise should link to the aim of a research project, therefore random sampling, for example, is prohibitive (Check and Schutt, 2012). All case study interviewees were selected as they potentially offered

insights regarding the unique nature of zoological street furniture accessibility, which could subsequently be used to evaluate the effectiveness of inclusive design as an analytical tool, in terms of contextual fit. Selection was however constrained, due to a lack of direct subject expertise. As a consequence of this, experts were selected whose knowledge related to either zoology or accessibility, as no available candidate evidenced a documented understanding of the correlation between the two topics. Moreover, incompatible geographical proximity reduced the number of desirable interviewees, especially in terms of the United States of America.

Interviewees harbour information, which researchers use to construct knowledge derived from the interview process (Miller and Glassner, 2011). Prior to conducting the case study interviews, the author felt that those selected to take part possessed latent knowledge relating to zoological street furniture accessibility. All but one of the interviewees possessed extensive zoology knowledge; however, it is unlikely that they had ever applied this understanding to the topic of street furniture accessibility, in any great detail. This argument highlights one of the key benefits of the case study interviews. They allowed for the extraction of latent knowledge, which was subsequently placed within a novel context for exploration and discussion.

Initially, the author had only planned to interview senior staff members from the four case study sites, however only the Welsh Mountain Zoo agreed to participate in this regard. This meant that other interviewees were considered. Although it would be inappropriate to name specific individuals, it should be noted that four people who were asked to take part, and who were not employed by any of the case study sites, declined the invitation to do so by failing to respond to communications. Presented here is a narrative, which explains individual interviewee selection in more detail, addressing issues such as bias and autonomy. Based upon guidance by Rowley (2012), interviewee profiles refer to employment and experience to establish subject authority. The information is provided in chronological order, relating to when the interviews took place. The timing of all of the interviews was influenced by interviewee availability and the natural progression of the research agenda. None of the interviewees had any kind of personal relationship with the author prior to taking part in the research. This is a noteworthy caveat, as the process of disclosure can influence how workplace and social

relationships develop post-interview (Le Voi, 2002). Table 4.1 summarises the interviewee details.

Interviewee	Date of Interview	Location of Interview	Topical Focus
Nick Jackson	18/11/2011	Welsh Mountain Zoo	Welsh Mountain Zoo
Peter Litherland	08/06/2013	Welsh Mountain Zoo	Welsh Mountain Zoo
Graham Garnett	13/06/2013	Cheshire West and Chester Council	Chester Zoo
John Lloyd	13/08/2013	Edinburgh Zoo	Edinburgh Zoo
Anthony Sheridan	11/09/2013	London Zoo	Edinburgh Zoo
Dr Paul Rees	18/11/2013	University of Salford	Belfast Zoo
Professor Geoff Hosey	12/02/2014	University of Salford	Chester Zoo

Table 4.1: Interviewee details

Nick Jackson: Director at the Welsh Mountain Zoo

Interview Date: 18/11/2011

Interview Focus: Welsh Mountain Zoo

Due to the initial intention to interview senior staff members at the case study sites, the Welsh Mountain Zoo's director was an obvious choice. Jackson was, and still is at the time of writing, enthusiastic about research relating to inclusive design and zoological street furniture. He acted as a gatekeeper for the second interviewee (Peter Litherland), allowed the two case study experiments to be conducted on-site at the Welsh Mountain Zoo, and took part in an interview himself in a helpful manner. Based upon his forty plus years of zoological experience and his current level of responsibility, his selection allowed for an informed perspective. His responses were also provided with a high level of autonomy due to his employment status, although he almost certainly considered the reputation of his organisation when answering questions. His interview took place at the Welsh Mountain Zoo.

Peter Litherland: Animal Collection Manager at the Welsh Mountain Zoo

Interview Date: 08/06/2013

Interview Focus: Welsh Mountain Zoo

Nick Jackson provided direct access to Peter Litherland, suggesting his inclusion. It is therefore possible that his taking part is subject to concerns over validity; he may have felt obligated to take part due to his employment. It is also possible that his responses during the interview were restrained by his employment, although the author failed to observe any instances when this curtailed his discourse. Like Nick Jackson, Peter

Litherland has been employed within the zoological community throughout his career and is currently employed in a senior position; hence, his inclusion as an interviewee was logical and informative. His interview also took place at the Welsh Mountain Zoo.

Graham Garnett: Senior Access Officer at Cheshire West and Chester Council
Interview Date: 13/06/2013
Interview Focus: Chester Zoo

Unlike the other interviewees, Graham Garnett offered no credible insight in terms of zoology, rather his expertise related to accessibility. As the research developed, the author realised that focusing upon the zoology context allowed for the accessibility of zoological street furniture to be explored in more detail and that, more importantly, examining the context/artefact relationship served to evaluate the effectiveness of inclusive design as an analytical tool. For this reason, subsequent interviewees were selected due to zoology knowledge only. Despite this, Garnett's contributions were useful due to his accessibility expertise, based upon over ten year's service as a senior access officer. Access to Garnett himself was not controlled by a gatekeeper, however his responses will have probably been provided with his employer in mind, especially as his interview was conducted at his employer's offices. Conversely, he has no association with Chester Zoo; therefore, bias in this regard can be discounted. It was logical to gather insights from Garnett relating to Chester Zoo as this organisation is within the council ward governed by Cheshire West and Chester Council.

John Lloyd: Author of ʻWonders Never Cease - Edinburgh Zoo into the 21st Centuryʼ
Interview Date: 13/08/2013
Interview Focus: Edinburgh Zoo

The selection of John Lloyd as an interviewee provided an informed perspective due to his previous tenure as a board member and patron at Edinburgh Zoo, where his interview took place. In addition, he is the author of a book detailing the organisation's history. Now retired, access to Lloyd was granted by his former publisher. Although his long-term support and passion for Edinburgh Zoo was evident throughout the interview, his responses were autonomous, if somewhat biased in favour of Edinburgh Zoo and zoological gardens in general.

Anthony Sheridan: Author of 'What Zoos Can Do'

Interview Date: 11/09/2013

Interview Focus: Edinburgh Zoo

Site-specific bias and general autonomy were of least concern with reference to interviewee Anthony Sheridan, who is retired and has no link to any particular zoological garden. He was selected as an interviewee as he has visited over 100 zoological gardens and profiled each of these organisations in his book 'What Zoos Can Do'. In this text, he ranks zoological gardens, including Edinburgh Zoo, based on factors such as the presence of iconic species and visitor education. Due to this, he is uniquely placed to offer zoological insights. Access to Sheridan was granted by his publisher. London Zoo was used as a meeting place for his interview, as it was a convenient location for the interviewee.

Dr Paul Rees: Senior Lecturer in Wildlife at the University of Salford

Interview Date: 18/11/2013

Interview Focus: Belfast Zoo

Access to interviewee Dr Paul Rees was facilitated via an internal communication from the author, as both were at the time of the interview, conducting research at the University of Salford, where the interview took place. Interviewee selection was based upon Ree's employment and his numerous academic publications, both of which relate to zoology. Like Anthony Sheridan, his expertise would have allowed him to comment on any of the case study sites. In terms of bias, Rees does not have a particular association with Belfast Zoo.

Professor Geoff Hosey: Co-author of 'Zoo Animals: Behaviour, Management, and Welfare'

Interview Date: 12/02/2014

Interview Focus: Chester Zoo

The final interview was conducted at the University of Salford, as this was a suitable and convenient location for both parties. Now retired, Professor Emeritus Geoff Hosey was formerly a principal lecturer in biology at the University of Bolton. He is also the co-author of 'Zoo Animals: Behaviour, Management, and Welfare' and has published many academic papers pertaining to zoological gardens. These facts combine to justify his selection as an interviewee. Hosey has conducted research at Chester Zoo, therefore

he was well placed to comment on the site's street furniture, although his general expertise meant that he could have equally discussed the other case study locations. Though not apparent during the interview, his affiliation with Chester Zoo could have influenced biased responses in the sites favour.

4.4.2.4 Ethics

Initial contact with all of the interviewees was made via email. Based upon guidance by Seidman (2006), potential participants were told what the purpose of the interview was, how much of their time would be required, what format the interview would take, how their contact details had been obtained, and why they were being approached. In the case of Dr Paul Rees, for instance, he was told that he had been selected as a potential interviewee due to his history of academic zoology publications. If a potential participant responded positively, follow up communications included details on where and when the interview would take place and additional contact details were exchanged. Although Seidman (2006) warns that email communications can be viewed with scepticism by potential interviewees, due to the nature of the medium, Meho (2006) argues that email use for research purposes is often cost effective, time saving, and quickly transcends geographical boundaries. Moreover, it allows for both synchronous and asynchronous communication (Silverman, 2011) and offers the opportunity for people to provide considered responses (Markham, 2011).

Informed consent occurs when people understand research procedures, and agree to participate based upon this understanding (Maxfield and Babbie, 2012). For this thesis, and in advance of each interview, participants were asked to read and sign a participant consent form, to insure that informed consent was provided. In support of this aim, the consent forms utilised simplified language to increase the likelihood of comprehension, as Maxfield and Babbie (2012) state that one of the central challenges of gaining informed consent is ensuring comprehension of research descriptions.

The participant consent forms repeated much of the aforementioned information that had been originally conveyed via email, when the interviewees were first contacted. Guidance by Seidman (2006) informed the additional content of the participant consent forms. Accordingly, participants were also told that they would be able to stop

proceedings at any time, without justification or consequence, and that following a request for withdrawal the option to retract all data provided would be presented. It was emphasised that participation was voluntary and that no external funding or sponsorship was in place. Contact details were provided for both the author and his academic supervisor, Professor Marcus Ormerod. These details were included so that questions could have been raised by those involved or those considering their involvement. The contact details section stated clearly that the author was a PhD student at the University of Salford. Due to the nature of the research topic and the interviewees selected, many ethical issues regarding potentially vulnerable participants and harm and distress were not of relevance. Nevertheless, data storage was addressed as part of the participant consent forms, to alleviate any related concerns.

As part of the participant consent forms, it was explained that interviewees would be directly named when references were made to their contributions. The author feels that when conducting in-depth interviews with subject experts, regarding a topic that is not generally considered to be private or personal, this approach provides enhanced credibility and a greater understanding of context for readers. For example, Professor Geoff Hosey is named directly; consequently, readers can review his published work to further explore and explain his position on zoological concerns. In addition, readers who are already familiar with his work can draw upon this knowledge when interpreting new data. It is however acknowledged that research participant anonymity is generally advocated in literature as it protects rights to privacy (King and Horrocks, 2010). Conversely, Elliott (2005) states that in some cases forcing anonymity upon participants fails to offer people the opportunity to convey ideas publically. Elliott (2005) also explains that the decision to protect participant identity is not only based upon their preferences, but is also determined by the nature of the research and the value that revealing identities can offer. She refers to research on sexual preference statistics to highlight an example of when the use of pseudonyms is preferable, as in a case such as this, there is no valid reason to name those involved. For this thesis, all interviewees were given a choice regarding anonymity, and all agreed to be named.

Interviewees were not offered any form of remuneration for taking part in the research process. To justify this position, it is worthwhile stating that the author had no funding to offer and has not benefitted financially from the case study interviews or the research

in general. One line of thought is that offering money for taking part in interviews can cause bias with participant motivations (Magnusson and Marecek, 2015). More significantly, from an ethical standpoint, receiving payment for discussing sensitive topics may present moral concerns for some participants (Shaw, 2012). Regardless of the position taken on this topic, the issue of payment should be clarified prior to involving participants to ensure informed consent (Magnusson and Marecek, 2015). For this reason, participant consent forms for the case study interviews clearly stated that no payment would be offered to those involved. Although the participants have not benefitted financially, they have been given an opportunity to share their opinions and discuss a topic, which is directly related to their own interests, as well as contributing to a heightened understanding of inclusive design.

It is acknowledged that had any of the interviewees been under 18 years of age, ensuring informed consent would have been more complicated. To illustrate this complexity, Kellett (2010) suggests that when interviewing children, consent should not only relate to guardians, but children themselves should also be asked if they are happy to participate. She goes on to state that conflicts can occur, for example, when children wish to be involved, yet guardians restrict access. None of the case study interviewees were asked for their age, as it was evident from their employment history and publications that they were all over 18 years of age. This fact was also visually apparent during each interview.

Class, ethnicity, gender, and cultural differences are all factors, which can impose themselves upon the interviewing relationship (Gillham, 2005). During the case study interviews, class differences were not profound. Had the interviews involved people living in impoverished conditions, for instance, this topic would have warranted further attention, *vis-à-vis* dimensions of power. In terms of ethnicity and gender, the author is a white male and all of those who took part were also observed to be white males. Again, these are not pertinent topics, as tension most typically arises when interviewer and interviewee are from different ethnic groups and of a different gender (Gillham, 2005). Finally, cultural differences were not considerable, as all involved reside in the United Kingdom. Had cultural differences been significant, this may have reduced opportunities for meaningful conversation, due to frequent misunderstandings (Sands, Bourjolly, and Roer-Strier, 2007). Despite the fact that all interviewees were white

males living in the United Kingdom, participant selection was based solely upon how expertise related to research focus; there was no intention to exclude potential participants based upon any discriminatory factors[5]. However, research undertaken by Miller and Glassner (2011) has suggested that similarities between interviewee and interviewer typically enhance trust and rapport, illustrating an advantage associated with this approach to conducting qualitative interviews.

What has been previously stated suggests that when differences between interviewer and interviewee are less apparent the interview process is less likely to be problematic. While this is often true, similarities can result in false assumptions regarding shared understandings, which may not exist (Seidman, 2006). For the case study interviews, the age difference between both parties helped to avoid this problem, as the author is considerably younger than all but one of those who took part. However, Seidman (2006) suggests that age differences can be problematic when conducting research interviews. He states that younger interviewers must be careful not to patronise older participants, for example. To establish boundaries, yet to allow each party a dimension of power, the author emphasised the expertise of the participants, whilst affirming control over the interview process.

Audio recordings were made during all of the interviews. These individual recordings were subsequently used as an *aide-mémoire*, during data analysis. This technique allowed for a highly accurate and valuable rendition of past events, as advocated by Kervin, Vialle, Herrington, and Okely (2006). Taking this argument further, King and Horrocks (2010) infer that researchers cannot properly analyse interview data without a full and accurate recording. To ensure equity, it was explained in advance to those taking part that audio recordings would be made and that only the author would ever hear the recordings, to which there were no objections. Kervin *et al* (2006) also state that modern technology allows for less intrusive recording devices and this appeared to be true, as none of the interviewees were negatively influenced by the device used. All audio recordings were made using a Sony Ericsson Xperia PLAY smartphone, via the Easy Voice Recorder application.

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[5] This in turn indicates dominant gender / ethnicity traits for zoologists.

Relevant contributions from the case study interviewees are discussed in subsequent chapters to support the central thesis argument, and meet the thesis research aim. Verbatim quotations from the interviewees are presented within individual appendices (3-9), offering evidence of these contributions for readers to refer to. The interview audio files are not included, to protect participant privacy.

In final preparation for the seven case study interviews, an application was made for ethical approval from the University of Salford. Approval was subsequently granted under reference CST 13/116 (Appendix 10). Prior to each interview, a non-disclosure agreement was also signed by each interviewee, to protect the originality of the research (see Appendix 11 for an example, signed by Professor Geoff Hosey). Witman and Johnson (2008) argue that even when confidentially is implied, non-disclosure agreements offer heightened confidentially protection of intellectual interests for academic researchers. For this thesis, a non-disclosure agreement template provided by Elance (2013) was adapted to meet the research agenda.

4.4.2.5 Data Analysis

Data analysis occurred not only after the interviews had been concluded, but also during the interview process. Kvale (2007) states that interviewers should begin to analyse and interpret data during conversation with interviewees and that this process of analysis shapes subsequent questioning of participants. This technique was fitting given the nature of the qualitative semi-structured interviews, during which researchers should encourage relevant elaboration (Hammersley, 2013). To present an illustrative example, John Lloyd independently raised a concern regarding how plastic street furniture can be seen to be rather vulgar if positioned next to naturalistic animal enclosures. As Lloyd had mentioned a novel and domain-specific issue, he was spontaneously prompted to discuss the topic further. It was important to explore domain-specific issues in detail as these ultimately established that an inclusive design analysis is context dependant, thus allowing for a substantiated evaluation of the effectiveness of inclusive design as an analytical tool.

After all of the interviews had been completed, a thematic analysis was conducted to structure the data that had been collected. Such a process involves merging key themes

from several interviews into a single coherent narrative, to focus meaning (Rowley, 2012). A thematic analysis seeks to establish commonalties and explanatory principles, while reducing data to only that which is relevant (Lapadat, 2010). When analysing the interview content, the criteria for reducing the amount of data related directly to the research aim. Specifically for the case study interviews, feedback was organised topically; for example, all interviewee comments regarding exhibit labels were grouped, allowing subsequent narrative regarding exhibit labels to be supported, by not only photographic data, but also interview findings. Themes were both emergent and prefigured, and referenced those previously established through the data analysis of the case study photographs. Whether emergent or prefigured, all themes sought to establish the unique nature of zoological street furniture accessibility, which is fitting given that Lapadat (2010) posits that undertaking a thematic analysis can reveal contextually grounded insights.

To rationalise undertaking a thematic analysis in more detail, it is appropriate to acknowledge a number of weaknesses typically associated with this approach. Braun and Clarke (2013) warn that by highlighting patterns within multiple interviews, continuity and contradictions within individual accounts are ignored. Although this is a valid concern, instances of participants contradicting themselves were extremely rare during the case study interviews. An additional concern is that participant individuality is lost by merging themes from separate interviews (Braun and Clarke, 2013). Personal idiosyncrasies are admittedly lost by the process of thematic analysis. While this can be viewed as unfortunate in that it reduces the quality of the accounts, it does not undermine the research agenda; in fact, it serves to apply focus upon relevant contributions and the desired outcome of the research. It is also acknowledged that the process described in this section disregards non-verbal cues, such as tone of voice, or facial expression, which can be highly revealing during data analysis (Anderson and Arsenault, 2002). Given the nature of the topic under discussion, this is a less pressing concern than it would have been for some more emotive subjects.

4.4.3 Experiments

Photographic data analysis revealed a number of sub-topics warranting further investigation, which could be used to contribute to a heightened understanding of the effectiveness of inclusive design as an analytical tool and to explain the unique nature of zoological street furniture accessibility in greater detail. Although it was not possible to explore all of these opportunities through experiments, due to time and funding limitations, two specific and in-depth experiments were conducted to provide quantitative backing for initial research findings and to test theoretical concepts with end users in a real life context. Topics were selected which clearly illustrated the unique nature of zoological street furniture, and therefore illustrated why inclusive design is context dependant. This section details how and why the two experiments were planned, implemented, and reported to contribute to the research aim.

4.4.3.1 Procedure and Classification

The first experiment gathered preferences from zoological garden visitors comparing two different directional signs, specifically one sign displaying a pictogram and one sign displaying a photograph for the brown bear (*Ursus arctos*) enclosure at the Welsh Mountain Zoo. The second experiment also gathered end user preferences, by comparing a set of three zoological logo designs: a plain text design, a design that hinted at a zoological connection through subtle imagery, and a pictogram design. Chapter 6 explains and justifies the selection of these two topics in detail. Both experiments were designed to gather end user preferences using prototypes. The process undertaken is comparable to undertaking user trials as an inclusive design research tool. Antona *et al* (2009) state that user trials assess product accessibility with real end users to gather personal insights. This description relates to what transpired for both case study experiments.

Photographic directional signs, in relation to the first experiment, and logos displaying animal imagery, in relation to the second experiment, were both theoretically highly accessible for a wide range of end users; especially regarding language barriers. However, what was theoretically highly accessible for zoological garden visitors may

not have actually been preferred; therefore, end user feedback was required to further establish the value of photographic directional signs and logos displaying animal imagery. Most significantly, testing preference was appropriate from an inclusive design perspective, as doing so explores end user aspirations.

Independent variables (cause) are those that are directly manipulated by a researcher (Randolph, 2008). For example, in the first experiment, the communication medium (pictogram or photograph) had been manipulated by the author, as had the distance at which the signs were viewed. Each manipulation of an independent variable is typically referred to as a level (White and McBurney, 2013). Dependent variables (effect) are influenced by changes to the independent variable and are subsequently measured by researchers (Randolph, 2008). For example, preferences for sign designs in the first experiment depended upon which communication mediums were displayed. Using Field and Hole's (2011) definition of the term, both studies can be classified as experiments, due to the intentional manipulation of independent variables. To offer a comparison, had observational studies been completed there would have been no such form of manipulation (Bakeman and Robinson, 2014). Given the topical focus, it is clear that watching people look at existing sign and logo designs, with no form of intervention, would not have been very revealing in terms of preferences, thus experiments were more appropriate than observational studies. As pointed out by Desposato (2016), experiments allow researchers to control variables of interest, without needing to rely upon real world events to generate significant occurrences.

While both experiments analysed communication mediums as an independent variable, the first experiment also took distance into account, specifically the distance at which the two sign designs were viewed by participants. Those taking part were asked to provide their preference at three separate distances, to establish if distance influenced preference. Although an analysis of distance was revealing, the fact that participants were asked to provide a response at all three distances highlighted a conditioning issue, which the author was only aware of after testing was completed. It is accepted that it would have been more appropriate to ask people to provide their preference at only one of the three distances, to ensure that they had not been influenced to repeat their first answer at the other two distances, for example. This potential conditioning issue was

brought to the author's attention during face-to-face conversation with Professor Jocelyn Evans, who was at the time of the discussion, employed by the University of Salford.

Both experiments gathered quantitative data and also qualitative feedback. The quantitative data, which was gathered, can be classified as being ordinal. The results from the first experiment, for instance, show that more participants preferred the photographic sign, but they do not show by how much. Participants could have had only a slight preference for this design or they could have had a strong preference, however the data does not convey this level of detail, nor does it do so for the second experiment. Kumar (2010) uses a race analogy to explain the nature of ordinal data, stating that it can tell us who wins a race, yet it cannot tell us if it was tightly contested or whether the winner was far superior to the person who finished in second place. Due to the limitation described here, it is acknowledged that the experiments would yield results that are more detailed if they were to be redesigned and repeated to collect interval data. For example, if the first experiment were redesigned, participants could be asked to rate each sign design out of ten. It can however be argued that the decision to collect ordinal data was justified, as interval data must be based upon equal intervals (Boslaugh, 2012), and when dealing with preference, it is questionable to quantify the term in this manner. In support of this, Field and Hole (2011) point out that a measurement such as an embarrassment level provides ordinal data, as it is not possible to ensure that one person's perception of embarrassment is the same as another. Therefore, it can be argued that self-report preference tests should be designed to capture ordinal data, despite the inherent restrictions. In addition, although ordinal data has limitations, it is far more useful than nominal data in this context. Nominal data only names or categorises and consequently presents no hierarchical data at all, categorising by gender for example (Boslaugh, 2012).

Although the two experiments were primarily conceived to provide quantitative backing for research findings, the opportunity was also taken to gather qualitative feedback from participants. As part of both experiments, those taking part were given the opportunity to offer additional feedback, in the form of a short narrative. This approach allowed for expansive responses, which offered a greater level of detail and freedom than would have been possible had a selection of preference without the opportunity to explain selection further or comment upon related issues had been presented. During the first

experiment, a number of participants chose to comment upon the influence of sunlight to explain preference selection, illustrating the expansive nature of the qualitative feedback. It would not have been possible to gather this kind of relevant information had questioning been limited to just preference selection.

While undertaking data analysis for the first experiment a potential systematic ordering effect was observed. It is possible that the results of the first experiment were influenced by all of the participants viewing the two sign designs in the same order. This argument is based upon the work of Rugg and Petre (2007) who state that the order in which people are shown images can influence preference. With this in mind, a Latin square design was utilised for the second experiment. This ensured that the order in which people viewed the logo designs was counterbalanced so that any ordering effects could be discounted. This is important, as randomisation in experiments allows casual factors to be isolated (Field and Hole, 2011). Figure 4.10 presents the Latin square design that was used, the basis of which is that each independent variable appears only once in each column and row (Hinkelmann and Kempthorne, 2008). Each row represents what was presented to 50 participants, therefore the first presentation order was utilised as frequently as the second and the third, in accordance with procedures outlined by Field and Hole (2011).

Logo 1	Logo 2	Logo 3
Logo 2	Logo 3	Logo 1
Logo 3	Logo 1	Logo 2

Figure 4.10: Latin square design

4.4.3.2 Validity and Reliability

With the exception of the independent variables, all other aspects of the sign and logo designs were identical during testing. For example, the font used for the three logos was the same for each design. This approach to experiment design ensures that results can be directly attributed to changes in the independent variable (White and McBurney, 2013). By controlling extraneous and spurious factors, the accuracy and internal validity of experiment results is enhanced, as the intrinsic relationship between the results and variables is established through an elimination of rival explanations (Ary, Jacobs,

Sorensen, and Walker, 2014). Ary *et al* (2014) note that factors such as high profile public events can threaten the internal validity of an experiment, if they are topically related. Gathering opinion on safety and security in the wake of a recent terror attack is likely to influence participant responses, for instance. When conducting the two case study experiments there were no related external events, which were likely to have affected the outcomes of the studies.

Participants for both experiments provided their preference for either a particular directional sign or logo design. Preference therefore required a clear and objective measurement. When conducting experiments the use of standard and well-established measures enhances construct validity (Ary *et al*, 2014). Accordingly, response forms for the experiments included a dictionary definition of preference for participants and other readers to refer to, despite the typicality of the term. Appendix 12 provides the participant response form for the first experiment. Field and Hole (2011) emphasise the importance of clarifying measurements for all involved parties when undertaking experiments, to enable participants and future readers of the experiment reports to understand how key terms have been defined and to ensure that measures are valid. In relation to construct validity, as the aim of the experiments was to assess preference, it was fitting to utilise preference as a measurement.

As preference is a self-report measurement, both experiments will have been subject to a small degree of measurement error, negatively affecting accuracy and construct validity. When behavioural measurements are taken during experiments, there is less likelihood of measurement errors than when taking self-report measurements (Stangor, 2011). For example, observing how long people spend looking at an enclosure in a zoological garden is unlikely to produce measurement errors, as long as a meticulous researcher is employed. Yet asking people how they feel about a topic is more likely to be subject to a degree of measurement error, as responses may be shaped by social constructs; people providing what they perceive to be the right answer, for instance (Rasinger, 2010). It is accepted that this issue was an unavoidable shortcoming concerning the construct validity of the case study experiments. However, as noted by Chan (2010), unless what is being measured is highly susceptible to self-deception, then the value of self-report data should not be dismissed. Social pressure regarding

preference selection for signs and logos would not have been significant during testing for most participants; hence, measurement error was not an insurmountable concern.

Monette, Sullivan, DeJong, and Hilton (2014) argue that conducting field experiments instead of laboratory experiments enhances external validity. This is because the need to establish compatibility between what transpired in a laboratory and what will transpire in a real world setting is reduced (Monette *et al*, 2014). Both case study experiments took place on-site at the Welsh Mountain Zoo. Other zoological gardens could have been utilised, with little to no impact upon the design of the experiments. Site selection was entirely based upon the Welsh Mountain Zoo's willingness to allow on-site research to be conducted and also its geographical convenience. While it has not been possible to do so as part of this thesis, repeating the two experiments at a different zoological garden would increase the external validity of the overall results. Mitchell and Jolley (2013) suggest that repeating a study in a different location and at a different time addresses external validity. Another consideration is that repeating the studies to check research instrument consistency would also increase the reliability of the experiments (Hoxley, 2008).

4.4.3.3 Participants

For the first experiment, all participants were visitors to the Welsh Mountain Zoo. The only stipulation was that those taking part had to be over 18 years of age. People who looked under 21 were not asked to take part, in an attempt to ensure that this rule was upheld. Despite the age restriction and specific location, random sampling was employed on-site. Given the correct research context, random sampling is a superior approach as it ensures that data is representative of a much larger group than is actually sampled (Shiraev and Sobel, 2016); in this case, the sample is used to represent United Kingdom zoological garden visitors in general. A further benefit of random sampling is that it saves time and money (Johnson and Christensen, 2012). For the second experiment, data was gathered from two separate groups. Firstly, visitors at the Welsh Mountain Zoo took part. Again, these individuals were over 18 and random sampling was utilised. Secondly, a smaller group of participants took part via email and social media. This group of participants were known by the author and were easily accessible. Their data was used to support the findings from the larger group who took part at the

Welsh Mountain Zoo and to test whether people who were not on-site at a zoological garden had different preferences. Nonetheless, it is accepted that the use of convenience sampling, such as this, is typically associated with biased results, which are not representative of the general population (Gravetter and Forzano, 2012). In this instance, the off-site sample included an unusually high percentage of people aged 39 years or less, due to the nature of the author's personal contacts.

End user feedback from older and disabled people is a central component of inclusive design research (Dong *et al*, 2007). Their involvement can be stratified, or it can be facilitated as part of random sampling, as was done during the two experiments for this thesis. While on-site at the Welsh Mountain Zoo, older and disabled people were not specifically sought after, nor were they in any way avoided. Depending upon the specifics of a research agenda, a key advantage of random sampling is that it considers disabled people as part of mainstream society, and not as a separate stratum; consequently, there is a compelling ethical argument for this approach. Langdon *et al* (2015) promote the use of random sampling for inclusive design research, stating that sifting measures inevitably exclude people falling outside of predetermined boundaries. Conversely, it is accepted that random sampling can result in a lack of contributions from marginalised groups (Arulanantham, 2014). In relation to this topic, it is recognised that the case study experiments presented a barrier for anybody who could not communicate, or could not understand a request to take part. Furthermore, both experiments were exclusively visual in nature, meaning that some people with a visual impairment were not able to participate.

All of the participants for the first experiment and most of the participants for the second experiment were zoological garden visitors. This was a logical selection criterion, as actual site visitors who are directly influenced by the design of zoological signage provided the responses. Babbie (2011) refers to this concept as representative sampling, stating that selecting participants who represent a specific population can enhance generality claims. In addition, approaching people to comment upon zoological street furniture in a zoological garden contextualised the process for those taking part. Had the same experiments been undertaken in a neutral location, such as a shopping centre, the questioning may have appeared to be unusual and out of place for some participants.

219 different on-site participants took part in the first experiment, while 100 different on-site participants took part in the second experiment. An additional 50 participants took part in an online version of the second experiment (see table 4.2). Although the samples would have ideally been larger, these numbers were deemed to offer enough evidence that results were not attributed to chance. Equally, it is generally accepted that researchers can rarely engage with an entire population they are studying (Johnson and Christensen, 2012). To explain the sample sizes further, given that the 150 people who took part in the second experiment had only three selection choices, the expected value, had there been no difference in terms of preference, was 50, which is much greater than five. This is significant, as experiments that gather sparse data and consequently have expected values of five or less lack external validity (Boslaugh, 2012).

	Onsite Participants	Online Participants	Total Number of Participants
Experiment 1	219	0	219
Experiment 2	100	50	150

Table 4.2: Experiment participants

The sample size for the first experiment was not only based upon expected values, but also upon annual attendance statistics for the Welsh Mountain Zoo. According to data provided by the Welsh Mountain Zoo, the organisation received approximately 126,000 visitors during 2010 (Jackson, 2011). This figure provided an approximate daily population of 345, which was utilised alongside a confidence level of 95% and a confidence interval of four to determine a sample size of 219, using an online sample size calculator provided by Creative Research Systems (2012). In this context, the chosen confidence level offered a 95% degree of certainty that gathered results were subject to the margin of error specified by the confidence interval. *'Confidence level refers to the likelihood that a range created around a simple statistic includes the population parameter' (Schwab, 2011: 185).* The chosen confidence interval means that results were subject to a 4% margin of error. A confidence interval estimates error and measures accuracy by accounting for uncertainty within a sample (Bruce, 2015). When planning the second experiment, expected values alone were deemed sufficient to establish an appropriate sample size. Conversely, for the second experiment, a confidence interval was established after results had been gathered to specify a margin

of error, using an online tool provided by McCallum Layton (2014). Again, a confidence level of 95% was used, as this is the academic convention (Moore, 2010). Yin (2009) recommends presenting a confidence interval to confirm statistical veracity for experiments, while Field and Hole (2011) state that presenting confidence intervals establishes how confident researchers can be that their findings fall between set boundaries.

Rubin and Babbie (2010) recommend conducting a pilot study prior to undertaking an experiment. They state that doing so can highlight data collection issues, as was the case for the first experiment. Van Teijlingen and Hundley (2001) add that conducting a pilot study increases the likelihood of successful research output, can assist others looking to conduct similar studies, and can be used to convince funding bodies of the feasibility of a research project. The first experiment was piloted on-site at the Welsh Mountain Zoo. Simulating the real experiment in this manner provided enough evidence that the experiment would function correctly when interacting with visitors. It also highlighted a number of minor problems and resultant adaptations. The original participant consent form stated that participation was likely to take up to ten minutes. The pilot revealed that five minutes was a more accurate timescale. Most significantly, the three reading distances were altered due to the pilot. One, three, and six changed to three, six, and nine metres. Pilot participants felt that a distance of one metre offered no value and that a distance of nine metres began to explore the legibility of the photographic sign over distance more effectively. Employing a distance of nine metres resulted in a revision of the floor marking apparatus, due to localised topography. The final change related to the participant response form. The preference selection options were amended so that participants could choose neither of the signs, based on a suggestion from a pilot participant to include this option.

An online pilot study was conducted for the second experiment; however, this did not reveal any data collection issues. Nevertheless, it did confirm that the second experiment would function correctly online and also suggested that it would function correctly on-site at the Welsh Mountain Zoo. Ideally, an on-site pilot test would have been conducted as well, had time and funding restrictions not been so acute. With these restrictions in mind, it was felt that the online pilot and the pilot for the first experiment

had provided enough combined evidence that the second experiment would function correctly both online and on-site, which it ultimately did.

4.4.3.4 Ethics

Ethical approval was granted for both experiments by the University of Salford and the Welsh Mountain Zoo. University of Salford ethical approval was granted under reference CST 12/17 (Appendix 13) for the first experiment and CST 14/32 (Appendix 14) for the second experiment. The Welsh Mountain Zoo's Director, Nick Jackson, approved both studies separately during face-to-face meetings with the author.

Many of the ethical concerns associated with the case study experiments were identical to those associated with the case study interviews. To ensure informed consent, and for both experiments, a participant consent form explained the nature of the research, what participation entailed, why participants had been selected to take part, and how long taking part would last. Confidentiality issues were also addressed, with the forms clearly stating that although collective data would be published, specific individuals would not be named, and that any personal data would be digitally password protected. Unlike with regards to the research interviews, there was no benefit in naming experiment participants, as these were randomly selected site visitors, rather than subject experts. Appendix 15 provides the participant consent form for the first experiment. All participants had to sign a consent form prior to taking part in either one of the experiments. Accordingly, simple language was used throughout, to increase the likelihood of comprehension, as advocated by Mechling, Gast, and Lane (2014).

Contact details for the author and his academic supervisor, Professor Marcus Ormerod, were presented at the foot of the participant consent forms. An email address and telephone number were presented for both parties and a postal address was presented for Professor Ormerod. These details offered people who took part the opportunity to raise follow up questions about the research. However, to date, no questions have been posed. Mechling *et al* (2014) emphasise the importance of providing contact details for research participants to refer to if required.

Rubin and Babbie (2010) argue that whenever possible research participation should be voluntary. They do however explain that this is not always possible, for example, when observing natural driving behaviours. The participant consent forms for the two experiments emphasised the voluntary nature of the research by clearly stating that people were under no obligation to take part should they not wish to do so. The option to cease proceedings at any time and to withdraw any data that had already been provided was also explained. For the first experiment, it was explained to potential participants that they had the option to answer selected questions, while opting to ignore others. This was not a concern for the second experiment as only one question was posed.

All researchers have a moral obligation to protect participants from both physical and physiological harm (Russell and Purcell, 2009), irrespective of whether they have signed a participant consent form outlining any threats to welfare (Le Voi, 2002). Academic ethical concerns typically refer to humiliation or deception, with experiments directly involving humans or animals being especially subject to ethical scrutiny (Le Voi, 2002). For the case study experiments, the nature of sign or logo preference selection meant that the process presented no specific risks in terms of physical concerns. Similarly, the topical focus and process was very unlikely to cause physiological distress. Following completion of both experiments, no evidence of any kind of harm was recorded. The information presented in this section suggests that the case study experiments did not present any major ethical concerns. In sum, conducting the experiments presented only minimal risk to participants. Russell and Purcell (2009) define minimal risk as being comparable to that experienced as part of the normal activities most people undertake during their daily routines.

4.4.3.5 Data Analysis

In terms of the quantitative data analysis, the prior collection of only ordinal data limited the analysis to the use of non-parametric statistical tests. Parametric tests are used to analyse interval or ratio data, while non-parametric tests are used to analyse ordinal or nominal data (Sheskin, 2004). As a general rule, it is preferable to gather interval or ratio data, which can then be analysed using a parametric test (Field and Hole, 2011). This is because parametric tests can analyse information that is more

complex and are therefore more likely to highlight important differences between data sets (Vaughan, 2003). Nonetheless, given the nature of the self-report data that was collected, the use of non-parametric tests was appropriate, and for both studies, statistical significance was confirmed using a non-parametric test. Specifically, Chi-Square tests were used to confirm statistical significance by establishing a p-value. Yin (2009) states that conventionally p-values of less than 0.5 are statistically significant. Field and Hole (2011) mention that Chi-Square tests can reveal if frequencies differ from chance observations, yet they cannot establish a direction of causality. However, given the nature of the case study experiments it would be illogical to state that preference changing due to different communication mediums had been misinterpreted, and that the actual direction of causality was communication mediums changing due to existing preferences.

Undertaking a qualitative content analysis involves subjectively coding text by establishing patterns within a data set (Hsieh and Shannon, 2005). The process emphasises the importance of contextual meaning; therefore, the purpose is not just to count how many times a topic is mentioned within a data set, but to understand why and how a topic's prominence or occurrence is of relevance and importance (Hsieh and Shannon, 2005). For both case study experiments, a directed content analysis was used to analyse the qualitative data that had been gathered. The analysis was directed as the coding process linked directly to inclusive design. Newby (2014) states that to be directed a content analysis must link to an existing theoretical framework, which in turn partially determines utilised coding schema. This process was different to that undertaken for the photography and interview data analysis; codes were used to illustrate and contribute towards an in-depth understanding of two specific sub-topics, as opposed to using codes to establish broad categories of zoological street furniture. Presenting in-depth evidence to explain further the unique nature of zoological street furniture accessibility supports the claim that the successful implementation of an inclusive design analysis depends upon an appreciation and understanding of context. The approach described here is aligned with the notion that a directed content analysis should be used to validate or extend theory (Hashemnezhad, 2015).

The initial coding process for both experiments involved categorising qualitative feedback based only upon preference selection (predetermined codes). Thus, for the

logo design experiment 33 people described how they preferred the logo displaying animal imagery and as a result, these comments were grouped together. The second stage in this process involved looking at the detail of these responses and then grouping responses based on why a preference existed. For instance, half of the people who described their preference for the zoological hint logo stated that it was chosen due to its use of colour. Exploring why preference existed allowed for a more detailed analysis of end user feedback, which explained more than which logo was preferred by also detailing why, in relation to key inclusive design topics, such as colour. The coding process not only identified reoccurring feedback categories but also ones of importance. Only one participant commented about the use of an exotic animal as part of logo design, yet as this point was of relevance, this participant's comments were selected as a key topic for discussion. The coding process for both colour and exotic animals linked directly to the descriptions provided by participants. This process can therefore be described as *in vivo* coding (King, 2008). A key advantage of a qualitative content analysis is that it allows for an exploration of topics of importance, even if they are only mentioned by a single participant (Schreier, 2012). Such topics are likely to be dismissed when conducting a quantitative content analysis, illustrating the value of incorporating a qualitative review.

The quantitative and qualitative data analysis process for the case study experiments involved reducing the gathered data for presentation, so that key findings could be concisely explained. In quantitative terms, this represented the results of statistical tests, while coding grouped qualitative responses so they could be viewed collectively, rather than individually, formed the basis of the qualitative data analysis. Rapley (2011) argues that a process of data reduction allows researchers to present information that is representative of their data, without the need to present entire data sets.

Within chapter 6 the two case study experiments are discussed and their results are presented to form part of a topical narrative, in relation to the thesis research aim. Therefore, full experiment reports are not presented as part of the main thesis text. Instead, these are housed as appendices, specifically Appendix 16 and 17. The following subtitles, which outline academic praxis, informed the structure of the experiment reports:

- *Title*

- *Abstract*

- *Introduction*

- *Method (sub-divided into the following sections:)*

  - *Design*

  - *Participants*

  - *Apparatus and Materials*

  - *Procedure*

- *Results*

- *Discussion*

- *References*

- *Appendices (not always present)*

(Field and Hole, 2011: 287-288)

4.5 Conclusion

Photographs, interviews, and experiments have all provided convergent evidence to address the thesis research aim. Photography has been employed as the principal research method, with interview questions and experiment topic selection stemming from an initial process of documenting street furniture using photography. The use of photographs, interviews, and experiments is compatible with not only the case study methodology, but also an interpretivist theoretical perspective and a constructivist epistemology, creating a holistic and appropriate qualitative research design. This chapter has emphasised the synergy of the combined methodological elements, to highlight their value as a collective. In addition, the process of triangulating data from multiple sources has increased the authority of the explanatory case study findings.

The following chapters present the case study findings from two opposing intellectual positions. Firstly, photographic data is utilised to illustrate how existing design guidance for accessible street furniture is applicable for zoological gardens. Secondly, a more detailed and persuasive argument is presented drawing upon photographic data as well as interviewee feedback and experiment data. The second intellectual position

substantiates the central thesis argument that zoological street furniture is unique and that the effectiveness of an inclusive design analysis is determined by the environmental framework in which it is conducted.

Chapter 5
Effective Inclusive Design

Illustrating the effectiveness of conducting an inclusive design analysis, irrespective of contextual factors of influence, is the core focus of this chapter. Empirical findings are presented from this distinct intellectual position, utilising photographic data to undergird the argument for contextual fit and for employing inclusive design as an uncontested concept. Chapter content cites inclusive design guidance that functioned as equally well for zoological gardens, as it would have in another location, such as a typical high street. Seating, litter bins, and signage are all discussed sequentially. Existing accessibility guidance for street furniture, established as part of the thesis literature review (chapter 3), is used to structure the narrative.

5.1 Seating

Regular accessible seating is useful for all users (Bonnett, 2013). For some older and disabled people, this will be of paramount importance, especially if they need to rest habitually (Global Alliance on Accessible Technologies and Environments, 2014). Evidence from the four case study sites revealed that seating was normally provided on a regular basis, although at all of the sites some walkways were observed with no seating for over 100 metres, conflicting with best practice guidance by Sawyer and Bright (2014). Data collection presented no evidence to question the need for regular seating in a zoological context. Consequently, inclusive design guidance functions in a positive and appropriate manner to improve the accessibility of seating in zoological gardens, by promoting regular provision.

Inclusive design guidelines concerning the specific position of seating are also applicable for zoological gardens. Arguments for increased seating provision on long and inclined routes (Lacey, 2004), and at changes in level (Centre for Excellence in Universal Design, 2013), are just as convincing in a zoological context as they are elsewhere, as is guidance for seating to be positioned only on firm and level ground (Canadian Standards Association, 2004). In general, case study observations showed

that seating provision responded to site topography and walkway length. Moreover, the majority of seats were positioned on firm and level ground, as shown in figure 5.1 from Chester Zoo. Figure 5.2, from the Welsh Mountain Zoo is not representative of the rest of the site's seating, yet it highlights why inclusive design guidance for this sub-topic is important and relevant. The seating shown is on a slippery incline, which may pose access issues for many older and disabled people.

Figure 5.1: Seat on firm and level ground   *Figure 5.2: Seating on a slippery incline*

Space for wheelchair users (Bonnett, 2013), pushchairs (Centre for Excellence in Universal Design, 2013), and working dogs (Sawyer and Bright, 2014) should be provided next to all outdoor seating. The argument for this form of provision is as appropriate for zoological gardens, as it is in any other location. Accordingly, observations revealed that the required space was available in most instances across the four case study sites. In relation to this issue, photographic data collection revealed a small number of corresponding access concerns, including seating on raised platforms and recessed seating. These designs prohibit wheelchair users from positioning themselves alongside outdoor seating and also create an access barrier for people with pushchairs or for working dogs. Both of these issues were observed at Edinburgh Zoo and Belfast Zoo, albeit infrequently. Recessed seating was also observed infrequently at Chester Zoo. Figure 5.3 shows seating on a raised platform at Edinburgh Zoo, while figure 5.4 shows recessed seating at Belfast Zoo.

Figure 5.3: Seat on a raised platform   *Figure 5.4: Recessed seat*

Height, width, and depth are all factors influencing the accessibility of outdoor seating. Specific design guidance suggests a height of between 380mm and 580mm (British Standards Institution, 2009), a width of 500mm (Newton, 2012), and a depth of 470mm (Vandenberg, 2008). Although variations were observed at all of the case study sites, most of these dimensions were either close to or aligned with best practice guidance. Case study evidence did not reveal any reason why standard inclusive design guidance for these sub-topics is not applicable for zoological gardens; seat depth has no impact upon animal welfare, for instance. Best practice guidelines also suggest that some seating be offered at a variety of heights, to cater for diverse end user needs (British Standards Institution, 2009); again, this is relevant in a zoological context. While seat

height varied at all of the sites, only Chester Zoo and Belfast Zoo offered significant variation, in what appeared to be an intentional manner, for a small quantity of on-site installations. Figure 5.5 highlights this practice at Chester Zoo. As an aside, it is noteworthy that no perch seating was documented at any of the case study sites, although there is no justifiable domain-specific reason for this shortcoming. Lacey (2004) recommends offering some perch seating, to increase accessibility through varied provision.

Figure 5.5: Seating at multiple heights

Both armrests and backrests help people sit down comfortably and get up from a seated position (Global Alliance on Accessible Technologies and Environments, 2014). The majority of seats offered both armrests and backrests at the Welsh Mountain Zoo (see figure 5.6) and Edinburgh Zoo; however, the opposite was true of the seating at Chester Zoo (see figure 5.7) and Belfast Zoo. When backrests were included, they were found to be at a suitable rake for most of the seating: around 110 degrees (Vandenberg, 2008).

Figure 5.6: With armrests and backrest   *Figure 5.7: Without armrests and backrest*

Even though a lack of armrest provision has been documented, it is unclear if this fact reflects an intention to consider the needs of wheelchair users, as for some people, armrests can obstruct wheelchair transfer (Global Alliance on Accessible Technologies and Environments, 2014). Accumulated findings for armrests and backrests did not reveal any reason why related accessibility guidance should not be adhered to in a zoological context.

Only Chester Zoo and Edinburgh Zoo varied seating type within a single row, which is significant, as best practice guidance suggests that doing so can cause confusion for some people with a vision impairment (Centre for Excellence in Universal Design, 2013). Figure 5.8 draws attention to this problem at Chester Zoo, which although infrequently observed at both sites, is an important accessibility concern. Case study observations offered nothing to suggest that this issue was less important in a zoological context, or in any way curtailed by domain-specific concerns. Thus, inclusive design functions to improve accessibility for people with a vision impairment.

Figure 5.8: Varied seating within a single row[6]

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[6] As shown by figure 5.8, seating division can also exclude larger people.

5.1.1 Seating with Tables

Picnic tables were in place at all four case study sites, yet none of the installations had been specifically designed to allow access for wheelchair users, as advocated by Hopper (2007). Figure 5.9 shows a typical example from Belfast Zoo. The Global Alliance on Accessible Technologies and Environments (2014) suggest a 2000mm clear space around picnic tables. While approach space varied greatly, very few installations offered a 2000mm perimeter at the four case study sites. Specific dimensions also varied, however most tables were approximately in line with best practice guidance, which suggests the following dimensions: underside clearance 680mm, width 750mm, and depth 480mm (Canadian Standards Association, 2004). Observations revealed that picnic tables present no domain-specific issues; in this instance, what is best practice elsewhere is also best practice for zoological gardens.

Figure 5.9: Picnic table

5.2 Litter Bins

Arguments stating that litter bins should be at an accessible height of around 1300mm (Centre for Excellence in Universal Design, 2013), be permanently fixed in place (Bell, 2008) and be more prevalent in busy areas (Shaftoe, 2008) are as relevant in a zoological context as in any other outdoor location. Almost all litter bins at the case study sites were approximately at an accessible height and permanently fixed in place, with only Belfast Zoo failing to take best practice guidelines into account.

As shown in figure 5.10, many of the receptacles at Belfast Zoo were far under the suggested overall height of 1300mm. Figure 5.11 shows one of a small number of freestanding receptacles, also at Belfast Zoo. In general, more litter bins were in place in busier areas at all four case study sites.

Figure 5.10: Small litter bin   *Figure 5.11: Freestanding litter bin*

Providing ample space around litter bins to enable ease of access and the need to position receptacles on level ground, as opposed to on raised platforms (Bonnett, 2013), are both pertinent accessibility concerns in a zoological context, as case study observations found no evidence to suggest otherwise. Again, only Belfast Zoo contravened best practice guidance. One of the litter bins at Belfast Zoo was difficult to access due to the position of a nearby advertising board, while many others were positioned on elevated platforms, which can cause detection problems for cane users (Bonnett, 2013). Figure 5.12 highlights both of these issues.

Figure 5.12: Litter bin on an elevated platform

5.3 Signage

5.3.1 Text

Much of the guidance for increasing accessibility using legible text is relevant for zoological gardens. In support of this statement, case study evidence did not highlight any incompatibility between context of application and standard inclusive design guidance concerning the use of both upper and lower case lettering (Hoefler, 2009), only using block capital letting for single words (Steinfeld and Maisel, 2012), and sufficient letter and line spacing and text sizes (Gibson, 2009). A number of related problems were observed at all of the four case study sites. Figure 5.13 presents an indicative example from Belfast Zoo, which illustrates how too much block capital lettering can negatively influence legibility.

Figure 5.13: Regulatory signage with block capital lettering

Signage that will be read for an extended period of time should be positioned at average eye height (Canadian Standards Association, 2004). Ideally, signs should be repeated at more than one height to cater for end user diversity (Ndhlovu Rooke, 2012). The guidance presented here is fitting for zoological gardens, given that data collection offered no evidence to the contrary. None of the case study sites offered identical installations at more than one height. Some signs were positioned at approximately average eye height, if they displayed an extended narrative for visitors to read, although the exact height of signage varied tremendously across all four case study sites.

Sans serif fonts are best used for short messages on signage, whereas for longer passages of text serif fonts enhance legibility (Graves and Graves, 2012). Ornamental fonts should be avoided for all public signage (Wilkinson, 2005). The choice of font to be displayed varied greatly at the four case study sites. Despite this variation, no instances were observed where domain-specific issues curtailed the value or applicability of related inclusive design guidance. The recommendation that italic or bold text is not used for extended passages of text (Wilkinson, 2005) is also relevant in a zoological context. This issue was observed on some signs across the four case study sites, with bold text being inappropriately used more often than italics.

The combined use of red and green or blue and yellow on signage can cause significant legibility concerns in terms of colour blindness (Whitehouse, 2000). Although colour combinations varied across the four case study sites, no domain-specific concerns contended the assertion that colour blindness should be considered when displaying text on signs. The combined use of red and green, or blue and yellow, was observed only at Chester Zoo, on a small quantity of signs. Figure 5.14 highlights red text on a green background. Similarly, displaying text against a patterned background is as unsuitable in a zoological context as it is elsewhere. From an inclusivity perspective, it is positive that none of the case study sites housed signage of this nature. Text displayed against a patterned background is particularly confusing for people living with dyslexia (Conlon, 2012).

Figure 5.14: Signage with red text on a green background

5.3.2 Imagery

None of the design guidance for accessible imagery on signage was found to be directly applicable in a zoological context, without the need for considerable reinterpretation.

5.3.3 Wayfinding

Distinctive landmarks were observed at all of the case study sites. This is significant in terms of wayfinding, as landmarks aid both orientation and navigation (Afrooz *et al*, 2014). In fact, for some people they are more useful than directional signage (Mitchell *et al*, 2003). Figure 5.15 from the Welsh Mountain Zoo illustrates why visual points of reference are as useful for zoological gardens as they are for any other outdoor location.

Figure 5.15: Bardic stone circle

Best practice guidance recommends that all directional signage be positioned in an overhead location (Steinfeld, 2011), with a vertical clearance of around 2300mm (Centre for Excellence in Universal Design, 2013). Permanent, as opposed to temporary signage should be used whenever possible (Burton and Mitchell, 2006). Photographic data collection presented no evidence to refute these suggestions in a zoological context. In terms of vertical clearance, only the Welsh Mountain Zoo positioned most of its directional signs in an overhead position. Figure 5.16 illustrates this practice. Temporary wayfinding signage was not observed at any of the case study sites.

Figure 5.16: Overhead directional signage

The international symbol for accessibility identifies accessible routes and facilities such as toilets (Noble and Lord, 2004). It was used to signify accessible routes and toilet facilities at the Welsh Mountain Zoo and Edinburgh Zoo. At Chester Zoo, it was used to denote an accessible lift, direct people towards a wheelchair hire centre (figure 5.17), and for toilet facilities (figure 5.18), while at Belfast Zoo, it was only used to indicate the presence of accessible toilets. Its use at the four zoological gardens was apt, although from an inclusivity perspective it should have been displayed more often, and in a more consistent manner, to indicate which routes were accessible.

Figure 5.17: Accessible lift and wheelchair hire centre directional signage

Figure 5.18: Toilet directional signage

Some of the guidance for accessible map design was found to be suitable for zoological gardens. Research revealed no reason why maps should not display 'you are here' markers and convey information using alphabetical or numerical directories, as advocated by Gibson (2009). All of the maps at Chester Zoo, Edinburgh Zoo, and Belfast Zoo displayed 'you are here' indicators. The maps at Chester Zoo and Belfast

Zoo presented numeric directories. No maps at all were present at the Welsh Mountain Zoo. Figures 5.19 and 5.20, both from Chester Zoo, highlight the use of a 'you are here' marker and a numeric directory.
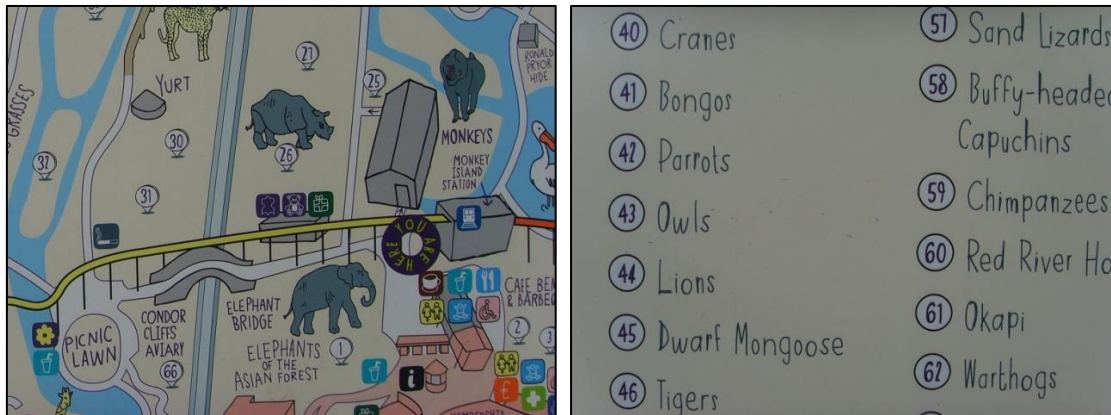
Figure 5.19: Map with 'you are here' mark Figure 5.20: Map with numeric directory

5.4 Conclusion

Conducting an inclusive design analysis at the four case study sites revealed which design guidance for accessible street furniture could be applied directly to zoological gardens. This chapter has highlighted a degree of contextual fit, based upon photographic data, which in turn promotes inclusive design as an uncontested and universally relevant principle. Much of the guidance for accessible seating, for example, functioned to increase accessibility, irrespective of domain-specific nuances. However, inherent omissions and the overall brevity of the chapter are as telling as its content, especially in relation to signage. While this chapter demonstrates that some inclusive design guidance functions in spite of milieu, the next chapter juxtaposes this position by presenting a far greater sum of evidence to argue that decontextualised inclusive design is largely ineffective; thus fostering an enhanced understanding of the purview of inclusive design as an analytical tool.

Chapter 6

Ineffective Inclusive Design

Drawing upon photography, interviews, and experiments, this penultimate chapter explains the unique nature of zoological street furniture accessibility in the United Kingdom. In doing so, it shows how the nuances of zoological gardens render general guidance for accessible street furniture ineffective. Subsequently, the central argument and findings of this thesis are presented through an evaluation of the effectiveness of inclusive design as an analytical tool, suggesting that it is context dependant. Design guidance for accessible street furniture is utilised to structure the chapter, with seating, litter bins, and signage all being discussed. The final section on signage most compellingly exemplifies the central argument through a plethora of domain-specific concerns, all of which delimit existing accessibility guidance and therefore illustrate the need for contextually aware practice.

6.1 Seating

Current inclusive design literature states that people need additional seating where they are likely to wait (Sawyer and Bright, 2014) and at important destinations (Newton, 2012). While these arguments are relevant in a zoological context, they are underpinned by factors not present in any other environmental framework. In zoological gardens, there are locations where more seating is needed due to the popularity of certain species; therefore inclusive design guidance is ineffective without an understanding of species popularity. This particular issue was raised by interviewee Anthony Sheridan (Appendix 7, part 1), who stated that most European zoological gardens do not have an adequate quantity of outdoor seating, particularly close to popular exhibits. Enclosure development in recent years has, in his opinion, increased the number of people who wish to sit and watch animals, which now reside in naturalistic enclosures and therefore behave in not only an innate manner, but also one more interesting for visitors; especially regarding active species, such as the red-faced spider monkey (*Ateles paniscus*). The central message here is that seating quantity is determined by species popularity, an issue not relevant in a typical high street environment. At the four case

study sites, seating provision generally increased to reflect species popularity. From an inclusive design perspective, the argument for additional accessible seating at popular enclosures serves to meet the needs and aspirations of a wide range of users.

Utilising colour contrast to reduce accidental collisions, especially for people with a vision impairment, is a significant concern in terms of outdoor seating design (Waterman, and Bell, 2011). However, case study observations revealed that naturalistic wooden seating was commonplace across all four zoological gardens and posed a heightened issue in terms of colour contrast in many instances, due to natural and arboreal surroundings not found in a typical city centre location. Figure 6.1 presents an indicative example from Belfast Zoo. The increased prevalence of wooden seating was explained by interviewee John Lloyd (Appendix 6, part 1) who raised concerns about plastic seating looking vulgar and out of place close to naturalistic animal enclosures or scientific research centres. Therefore, inclusive design guidance regarding colour contrast is in conflict with the need to maintain a naturalistic environment, uninhibited by garish colouration. Despite this domain-specific concern, figure 6.2 from Chester Zoo shows how natural wood coloration and fitting levels of colour contrast can both be taken into account, underlining the benefits of a contextually aware approach to inclusive design. This is significant, as feedback from older research participants has shown that wooden seating is often preferred, as it is deemed to be welcoming and attractive (Burton and Mitchell, 2006). In support of this line of thought, interviewee Graham Garnett (Appendix 5, part 1) raised concerns about metal seating, stating that it can be uncomfortably hot or cold to touch, depending upon ambient temperature.

Figure 6.1: Seat in arboreal surroundings   Figure 6.2: Effective colour contrast

Empirical evidence highlighting that zoological seating is generally of wooden construction relates not only to colour contrast and its impact upon ambience, but also to sustainability. Interviewee John Lloyd (Appendix 6, part 2) put forward the case for zoological seating to be made from natural and recycled materials. He explained that as United Kingdom zoological gardens are conservation organisations they should foster a holistic green ethos. His argument highlights further the complex relationship between accessibility concerns, such as colour contrast, and divergent issues, such as sustainability.

Much of the guidance for accessible seating represents a partial fit. While not being irrelevant, it requires reinterpretation to function appropriately. The argument that seating should be positioned so that people can enjoy picturesque views, or observe points of interest (Centre for Excellence in Universal Design, 2013) presents a further example of this tendency. Interviewee Professor Geoff Hosey (Appendix 9, part 1) discussed the location of seating in detail. He stated that in zoological gardens, most visitors prefer seating to be positioned where it allows for clear views of the animals on display. An added complexity raised by the interviewee is that seating can be positioned where it negatively affects animal wellbeing. To illustrate this argument, it was explained during the interview that people sitting and eating can be stressful for some primate groups, and as a result, grounds staff should locate seats accordingly. Therefore, implementing inclusive design guidance requires species-specific knowledge, so that related animal welfare concerns can be taken into consideration. Observations revealed that seating was not always positioned with clear views of animals in mind at the four case study sites, meaning visitors were required to stand to view many of the enclosures. Figure 6.3 presents an exception to this rule at the Welsh Mountain Zoo.

Figure 6.3: Enclosure viewing window

Best practice guidance also suggests that seating be offered in a quiet sheltered location (Centre for Excellence in Universal Design, 2013) or amenity area (Global Alliance on Accessible Technologies and Environments, 2014). However, observations across all of the case study sites revealed that doing so would typically conflict with a common desire to view popular species, which are normally found in relatively noisy and open plan locations. Similarly, Mitchell *et al* (2003) suggest that some seating is positioned at a right angle to aid communication for people with a hearing loss, yet implementing this proposal would affect animal viewing opportunities for others. These points again highlight a conflict between inclusive design best practice and the zoological context. In terms of empirical evidence, a very small quantity of sheltered seating or seating in an amenity area was in place at all of the four case study sites, such as figure 6.4 from Chester Zoo, whereas only Chester Zoo positioned a very small number of seats at a right angle, as shown in figure 6.5.

Figure 6.4: Sheltered seating   *Figure 6.5: Seating at a right angle*

A combination of fixed and movable seating was in place at all four case study sites. During the interview with Peter Litherland (Appendix 4, part 1), he explained that visitors typically move seating around to improve animal viewing opportunities. This in turn suggests that fixed seating is generally preferable in zoological gardens, as otherwise visitors can move seating into a dangerous or obstructive location; moving a seat to a position where it functions as a makeshift step into a dangerous enclosure or body of water unquestionably poses a health and safety concern. Nevertheless, this proposed and contextually aware approach poses an issue in terms of accessibility. This

is because movable outdoor seating is useful for many disabled people, as it offers more flexibility, particularly for wheelchair users (Sawyer and Bright, 2014).

An added tension regarding the position of seating was raised by Peter Litherland (Appendix 4, part 2) on the subject of street clutter, which is a particular concern for people with a vision impairment (Burton and Mitchell, 2006). He stated that as zoological gardens in the United Kingdom normally offer commemorative installations, it is customary for benefactors to have a say in where seats are positioned, typically disregarding street clutter concerns. A small number of seats displaying commemorative plaques were observed at all of the case study sites. Figure 6.6 presents an example from the Welsh Mountain Zoo.

Figure 6.6: Commemorative plaque

A final yet significant domain-specific seating topic relates to the presence of animal-themed installations, which were observed at Chester Zoo (figure 6.7), Edinburgh Zoo (figure 6.8 and 6.9), and Belfast Zoo (figure 6.10), but not at the Welsh Mountain Zoo. Design guidance for accessible street furniture promotes clarity of function as a key consideration, advocating traditional designs to enhance comprehension for older people in particular (Burton and Mitchell, 2006). Interviewee John Lloyd (Appendix 6, part 3) put forward an alternative point of view, suggesting that animal-themed street furniture is highly appropriate for zoological gardens, as it presents photo opportunities for visitors and enhances wayfinding, as well as being enjoyed by young children, whom make up a considerable percentage of the visitor profile. Lloyd's argument explains the conflict between access guidance and the unique nature of zoological street furniture, contributing to the central thesis argument that each inclusivity analysis is highly context dependent.

Figure 6.7: Animal-themed seating

Figure 6.8: Animal-themed seating

Figure 6.9: Animal-themed seating

Figure 6.10: Animal-themed seating

6.2 Litter Bins

Feedback from case study interviewees suggests that animal welfare concerns typically increase the significance of guidance for accessible litter bin provision in a zoological context; thus, inclusive design is ineffective unless greater emphasis is placed upon this topic. This issue is particularly apparent concerning ongoing maintenance, which is an important consideration for all outdoor litter bins (Shaftoe, 2008). Interviewee Anthony Sheridan (Appendix 7, part 2) indicated that due to increased sanitary concerns, linked to animal welfare, there is more of a requirement for regular emptying of litter bins in zoological gardens than for those found elsewhere. In support of this argument, interviewee Dr Paul Rees (Appendix 8, part 1) added that litter often attracts birds that carry diseases such as botulism, increasing the likelihood of transmission to captive animals through avian faeces. Furthermore, Rees (Appendix 8, part 2) advocated the regular emptying of litter bins, so that species of wasps are not attracted, mentioning the high number of children who visit zoological gardens as an extra justification for not wanting to attract stinging insects. Very few full litter bins were observed at the case study sites. The highest number was seen at Belfast Zoo. Figure 6.11 illustrates why this is a problem for all visitors, regardless of age or ability.

Figure 6.11: Full litter bin

Further interviewee feedback also contributed to the argument that the specifics of litter bin design are of increased importance for zoological gardens, hence a domain-specific approach to inclusive design is required, which places greater emphasis upon this topic. While accessibility guidance does advocate swing lids on litter bins (Burton and

Mitchell, 2006), John Lloyd (Appendix 6, part 4) stated that open-top receptacles should never be used in a zoological context. He believes that local wildlife attempting to scavenge from litter bins is more of an issue in zoological gardens, as the presence of animal residents attracts local wildlife; emphasising the need for covered apertures, in all instances. Despite the importance of this topic, all of the litter bins at the Welsh Mountain Zoo and Chester Zoo had permanently exposed apertures for waste disposal. Figure 6.12 from the Welsh Mountain Zoo and figure 6.13 from Chester Zoo present relevant examples. Conversely, the majority of installations at Edinburgh Zoo included swing lids (figure 6.14), while at Belfast Zoo visitors are normally required to lift a lid to deposit waste. As shown in figure 6.15, although most of the litter bins at Belfast Zoo included aperture covers, they are likely to pose access issues for people with limited dexterity; lifting a lid to deposit waste normally requires increased strength and dexterity, in comparison to pushing a lightweight flap. People living with obsessive-compulsive disorder and associated concerns over hygiene may also find this process difficult to complete, as the litter bin must be touched. Offering further accessibility critique, interviewee Dr Paul Rees (Appendix 8, part 3) added that the design would be difficult for wheelchair users to make use of, due to the angle at which the aperture cover must be lifted. This example highlights the need for contextually aware practice, taking into account not only domain-specific nuances, but also accessibility for a diversity of users.

Figure 6.12: Exposed aperture (plastic)   *Figure 6.13: Exposed aperture (wood)*

Figure 6.14: Litter bin with swing lid   *Figure 6.15: Litter bin with lift lid*

6.3 Signage

6.3.1 Text

Current guidance stresses the importance of displaying text, which contrasts the background it is displayed against, as doing so is especially useful for many people with a vision impairment (Steinfeld and Maisel, 2012). While this topic is relevant for zoological gardens, high levels of colour contrast on signage can negatively influence on-site ambience. This issue was raised by interviewee Nick Jackson (Appendix 3, part 1), who stated that vivid signage can detract from the visitor experience in terms of aesthetics. He noted that this was an especially pertinent concern for regulatory signs and suggested that a balance needs to be struck, where clarity and ambience can both be upheld, while gently warning people about health and safety concerns. Due to the argument put forward here, indiscriminately adopting inclusive design principles for this topic would conflict with the inherent nature of most zoological gardens.

Levels of colour contrast on signage varied greatly across all four case study sites. Figure 6.16, from Chester Zoo, highlights how insufficient colour contrast between text and background can cause legibility issues for people of all ages and abilities, whereas figure 6.17, from Edinburgh Zoo, illustrates how sufficient colour contrast can enhance clarity.

Figure 6.16: Insufficient colour contrast   Figure 6.17: Sufficient colour contrast

Taking his argument further, Jackson (Appendix 3, part 2) added that due to the nature of zoological gardens it is sometimes useful to make regulatory signage intentionally ambiguous, to avoid overly prescriptive messages. He explained that figure 6.18[7] had been carefully worded to be intentionally ambiguous. When designing this sign, the primary concern was that when people touch the site's penguins it can be harmful to the birds rather than to the visitors. Nevertheless, the sign is designed so that people interpret it in a way that suggests it can be harmful for both parties, however unlikely this may be[8]. Clarity is important from an access perspective, yet as this example indicates, the effectiveness of an inclusive design analysis can be influenced by nuanced environmental factors, such as visitor satisfaction and animal welfare.

Figure 6.18: Touch restriction sign

Central to the discipline of accessible signage is the provision of Braille or tactile lettering for people with a vision impairment (Grant, 2013). Specifically, lettering should be raised between 0.8mm to 1.5mm (Canadian Standards Association, 2004). Interviewee Anthony Sheridan (Appendix 7, part 3) stated that he had seen very little Braille in Europe's zoological gardens and believes that most sites would not expend capital on any form of tactile signage, as the visitor experience is very visual and due to this the percentage of visitors who would benefit from it is very small. Therefore, in his opinion, it would be difficult to justify economically. This viewpoint is contrary to inclusive design praxis, specifically the ethical case; however, it presents a domain-

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[7] This sign displays only block capital lettering, which can negatively impact legibility (Steinfeld and Maisel, 2012).

[8] Handling of penguins can be stressful for the birds, leading to a number of problems such as nest desertion (Wilson, 1997). Conversely, doing so is unlikely to distress visitors, as penguins will appear tolerant of handling, compared to most other birds (Bingham, 2001).

specific rationale, which questions the effectiveness of an inclusive design analysis in a zoological context. Observations at the case study sites revealed that only Belfast Zoo offered a small quantity of Braille on signage (see figure 6.19), while none of the sites offered tactile lettering.

Figure 6.19: Braille on toilet directional signage

On the topic of multisensory feedback, further conflicts question the effectiveness of inclusive design for zoological gardens. Although not discussed by the case study interviewees, literature suggests that audio and olfactory signage poses domain-specific problems, despite being useful for many people with a vision impairment (Grant, 2013). Sound can have both a positive and negative impact upon animal welfare (Wark, 2015). The level of influence depends upon the nature of the noise and the species in question, and while much is unknown, research has suggested that for callitrichine monkeys quieter environments are preferable (Wark, 2015). Therefore depending upon the species in question, the provision of nearby auditory signage may be unsuitable, illustrating a conflict between inclusive design best practice and animal welfare. Olfactory signage may pose similar concerns, as odours can influence feeding, foraging, and mating behaviour, depending upon species type (Nielsen, Jezierski, Bolhuis, Amo, Rosell, Oostindjer, Christensen, McKeegan, Wells, and Hepper, 2015). In terms of empirical data, none of the case study sites housed either audio or olfactory signage.

According to Gibson (2010), multilingual signage, conveying text in more than one language, can increase access to information, especially in bilingual environments. Only

at the Welsh Mountain Zoo did signs display more than one language[9]. Most signs displayed both English and Welsh text, as shown in figure 6.20. While this is a pertinent subject in terms of this thesis, interviewee Nick Jackson (Appendix 3, part 3) pointed out that for zoological gardens, having a bilingual policy reduces the amount of natural history education on exhibit labels, or it can increase costs and detract from a site's ambience if larger signs are procured to accommodate more text. Either way, half the available space on each sign must be dedicated to a separate language. The point made suggests that inclusive design best practice may be more difficult to implement in a zoological context; therefore, it is less effective.

Figure 6.20: Sign displaying English and Welsh text

Existing domain-specific guidance promotes the use of simplistic vocabulary on exhibit labels to increase understanding, especially for young children (Yew, 1991). Observations from the four case study sites revealed that the reading age of text varied significantly due to the wide variety and large number of exhibit labels on display. How animal diets were discussed on signage helps to explain the topic further. While some signs referred to carnivorous, omnivorous, or herbivorous species, others listed specific food sources, in a simplistic manner. Observations also revealed that a small number of signs were designed specifically for children, albeit only at Chester Zoo. Figure 6.21 presents an example. Empirical data concerning this topic is supported by feedback from the case study interviewees, drawing attention to an inherent complexity and dichotomy. Interviewee Peter Litherland (Appendix 4, part 3) suggested that exhibit

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[9] Offering dual language signage is not a legal obligation for the Welsh Mountain Zoo. The Welsh Language Act only extends to public sector organisations; however, the Welsh Mountain Zoo provides signage in both languages out of respect for the local population.

labels display simple messages, to increase comprehension for people of all ages and abilities, and to retain visitor attention. In opposition, Dr Paul Rees (Appendix 8, part 4) stated that only designing signage for children typically devalues the conservation work that most zoological gardens undertake, directly influencing public perception. This point highlights a conflict between increasing comprehension, and conveying conservation education for adult visitors. Feedback also referred to possible design solutions to suit different user needs. John Lloyd (Appendix 6, part 5) suggested that words such as carnivore are included on signage but that they are also explained; figure 6.22 highlights this approach in practice, which is inclusive of varied reading ages, yet retains an educational ethos. A final proposal, put forward by interviewee Graham Garnett (Appendix 5, part 2) is for zoological gardens to present accessible and easy to understand language on exhibit labels, but to offer supplementary information as part of guided tours. Synthesised interviewee feedback highlights the unique and complex nature of zoological street furniture accessibility, as issues surrounding natural history reading ages are not applicable for signage in a typical high street environment. Equally, it suggests that conducting an inclusive design analysis is ineffective without an awareness of how simplistic content can devalue conservation work. In this instance, the intent is not to propose a definitive solution, but rather to illustrate how and why the zoological context and its associated nuances limit the effectiveness of an inclusive design analysis.

Figure 6.21: Exhibit label for children   *Figure 6.22: Ring-tailed lemur (Lemur catta) exhibit label*
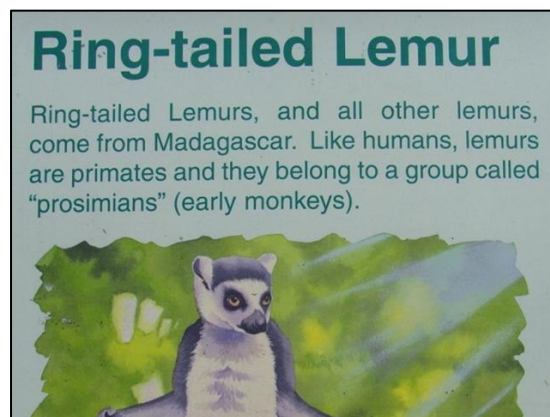
Data collection from the four case study sites revealed that all exhibit labels displayed both the common and Latin name for each species. Figure 6.23 presents an example from Edinburgh Zoo. When questioned about visitors understanding of Latin, interviewee Peter Litherland (Appendix 4, part 4) claimed that its inclusion on exhibit labels, alongside a species common name, is an important piece of information. Common names, he stated, can confuse as numerous species have more than one. For example, the morepork (*Ninox novaeseelandiae*), is also called the Tasmanian spotted owl, yet all species have only one Latin name. As a result, displaying a universally accepted Latin name, in his estimation, reduces confusion over species type. This argument offers a domain-specific rationale, suggesting that omitting Latin to enhance simplicity and increase comprehension for a lay audience would be inappropriate, given the nature of the zoological context.

Figure 6.23: Drill (Mandrillus leucophaeus) exhibit label

6.3.2 Imagery

A key aspect of accessible signage is the inclusion of imagery to overcome language and literacy barriers (Fielding, 2009), especially for young children (Prosser and Burke, 2008). While this argument is generally fitting in a zoological context, utilising broad inclusive design guidance is also problematic, in that it fails to address or detail domain-specific concerns. This section shows how imagery is used on a number of different sign types found only in zoological gardens. In doing so, it explains the unique nature of zoological street furniture accessibility in the United Kingdom, whilst also evaluating the effectiveness of inclusive design as an analytical tool, by establishing the prevailing influence of context.

All of the exhibit labels at the four case study sites displayed imagery to identity species type. The majority at both the Welsh Mountain Zoo and Chester Zoo displayed illustrations, while photographic imagery was prominent on the exhibit labels at Edinburgh Zoo and Belfast Zoo. Figure 6.24 highlights the use of an illustration at Chester Zoo. Figure 6.25 shows photography being displayed at Belfast Zoo. In relation to this topic, interviewee Professor Geoff Hosey (Appendix 9, part 2) argued that photographic imagery is superior as it provides anatomically correct data, rather than a subjective artistic impression, therefore it can be used to demonstrate animal behaviour in an authentic manner. By highlighting the need to provide natural history education through imagery, this argument expands upon guidance put forward by Calori and Vanden-Eynden (2015), advocating clear, as opposed to decorative photography. As this concern is not relevant elsewhere, it is a domain-specific issue. Without an understanding and awareness of this need, an inclusive design analysis is ineffective.

Figure 6.24: Greater one-horned rhinoceros (Rhinoceros unicornis) exhibit label

Figure 6.25: Red river hog (Potamochoerus porcus) exhibit label

Interviewee Peter Litherland (Appendix 4, part 5) also contributed to this topic, explaining why advocating imagery inclusion alone is insufficient, due to nuanced zoology concerns. He described the difficulty he has experienced identifying waterfowl out of their breeding season, when they display eclipse plumage. This in turn suggests that while a single generic photograph can be used for many species, multiple images are sometimes required, due to diverse physical appearances influenced by seasonal variations, mutations, life cycle changes, and gender. Melanistic and albino animals, those with deciduous antlers, and the metamorphosis of caterpillars into butterflies present a number of specific examples. Case study observations revealed that only one exhibit label across the four sites took this issue directly into account; figure 6.26 from Chester Zoo highlights the difference between male and female Blackbuck (*Antilope cervicapra*) using dual imagery. The argument detailed here illustrates why an awareness of domain-specific concerns is required to practice contextually responsive inclusive design. Presenting a similar argument, interviewee Professor Geoff Hosey (Appendix 9, part 3) stressed the need for manifold identification imagery for multi-occupancy enclosures, to help visitors distinguish between different species. He also pointed out that it is useful to provide distinct images of individual animals; another issue not present outside of a zoological context. Doing so, he believes, raises awareness and empathy, and can positively influence donations by the public. Figure 6.27 presents an example of how signs at Edinburgh Zoo depict individual animals; in this case, a male called Yang Guang. This practice was observed at all of the case study sites, but only for iconic species, such as the giant panda (*Ailuropoda melanoleuca*).

Figure 6.26: Blackbuck (Antilope cervicapra) exhibit label

Figure 6.27: Sign depicting Yang Guang

At Edinburgh Zoo, a unique approach to imagery use was documented, which illustrates how an art style, rather than a particular image, can be utilised to convey a lucid message. Images of Australian species and Aboriginal colour and form are used to prime visitors that they are close to the Queensland koala (*Phascolarctos cinereus adustus*) exhibit, irrespective of language comprehension; instead, communication is subject to a cultural understanding. Edinburgh Zoo does not house any species of Kookaburra, nor does it house any platypus (*Ornithorhynchus anatinus*). However, the images shown in figures 6.28 and 6.29 convey an apparent message. This practice was not observed at any of the other case study sites, nor did any of the interviewees offer related feedback, yet it could be used for many other species.

Figure 6.28: Kookaburra image

Figure 6.29: Platypus (Ornithorhynchus anatinus) image

Species distribution maps were displayed alongside animal identification imagery on all of the exhibit labels at the Welsh Mountain Zoo, Edinburgh Zoo, and Belfast Zoo, and

on some of the exhibit labels at Chester Zoo. Figure 6.30 shows an example from the Welsh Mountain Zoo. As this image type is not found on signage in a typical high street environment, it is a confirmed domain-specific topic.

Figure 6.30: Lar gibbon (Hylobates lar) exhibit label

While species distribution maps transcend language barriers using imagery, existing inclusive design guidance fails to address a number of related complexities, therefore it is ineffective without reference to the specific nature of species distribution cartography. Interviewee feedback addressees this shortcoming, by explaining the unique challenges associated with designing maps to convey accessible, yet contextually relevant, information for site visitors. Interviewee Anthony Sheridan (Appendix 7, part 4) explained that when a species has an extremely limited distribution it is very difficult to reflect this fact on a world map, in a legible format; therefore localised maps displaying a single continent or country need to be used as and when it is appropriate to do so. For example, displaying a world map is suitable for a species with a global distribution, such as the common raven (*Corvus corax*), but for species such as the Bali starling (*Leucopsar rothschildi*), which resides only in Bali, a localised map is required to enhance clarity. Interviewee Professor Geoff Hosey (Appendix 9, part 4) offered further feedback, suggesting that for fully domesticated species like the Bactrian camel (*Camelus bactrianus*) displaying any kind of didactic map is irrelevant and inappropriate. In addition, he stated that even when legibility is considered, distribution maps can be specious, particularly if they suggest that a species resides in a larger area than it does in actuality. For example, a species may be endangered, but due to its distribution, a visual representation of its range can indicate incorrectly that its population numbers are high. Equally, a species may be abundant, but only within a

small geographical area, so a map can wrongly suggest a problem, which does not exist. A final point made by interviewee Dr Paul Rees (Appendix 8, part 5) is that displaying localised information alongside a world map can enhance clarity, as the world map is widely recognised. Figure 6.31 from Edinburgh Zoo illustrates this approach. In sum, feedback from the interviewees illustrates why species-specific knowledge is required to design accessible distribution maps for public display.

Figure 6.31: Gelada baboon (Theropithecus gelada) species distribution map

Research observations highlighted a number of instances where imagery was not currently employed to convey a domain-specific message. In turn, these omissions functioned as a catalyst for commentary from the case study interviewees. Most exhibit labels at all of the case study sites displayed Red List data provided by the International Union for Conservation of Nature, yet none included related imagery. Signs of this nature are designed to help people understand how threatened a species is, and normally display the following categories:

- not evaluated
- data deficient
- least concern
- near threatened
- vulnerable
- endangered
- critically endangered
- extinct in the wild
- extinct

Discussion with the case study interviewees focused upon how imagery could be used to increase the accessibility of Red List data, for people who cannot read English text; using a dodo (*Raphus cucullatus*) image to represent the 'extinct' category, for instance. Concerning this topic, interviewee Professor Geoff Hosey (Appendix 9, part 5) claimed that some of the species that would be highly appropriate to display, from a conservation perspective, would be unfamiliar to many people. For extinct in the wild, he stated that the scimitar-horned oryx (*Oryx dammah*) would be a suitable selection, but that people would not know what it was. He elaborated, stating that deserving and critically endangered species may be visually unappealing, such as the giant ditch frog (*Leptodactylus fallax*) (which is also known as the mountain chicken), therefore its inclusion would not engender empathy and passion for conservation. Also, he felt that an image of a type of frog would pose confusion, as people would think that frogs are abundant. Due to the issues discussed, he did not feel that imagery should be utilised to increase comprehension, as species selection would be too complex. Nor would interviewee Anthony Sheridan (Appendix 7, part 5) pursue the concept of using imagery when conveying Red List data, as he felt that the choice of species to represent each category would cause disagreement and controversy amongst zoologists. It is his view that colour coding would continue to suffice and that this could be improved upon by using red for 'critically endangered' and green for 'least concern'. This he claimed would enhance clarity by referencing an inherent understanding that these two colours represent negative and positive in many contexts. Feedback from the case study interviewees concerning the Red List highlights the unique nature of zoological street furniture accessibility. Moreover, it evaluates the effectiveness of inclusive design, by questioning the notion that using imagery to increase accessibility is positive and appropriate in all instances. Figure 6.32 from Edinburgh Zoo shows Red List data.
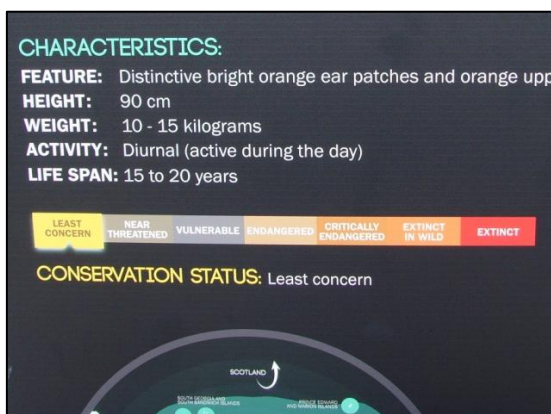
Figure 6.32: Red List data

An absence of imagery also prompted discussion with the interviewees regarding regulatory signage. Most of the feedback centred upon feeding restriction signs. Although all of the four case study sites displayed feeding restriction messages, very few signs utilised imagery to transcend language barriers. Figure 6.33 from Chester Zoo shows an archetypal text only design. As this sign type is not normally present outside of a zoological context, this is a confirmed domain-specific topic[10]. While the argument for imagery inclusion is fitting for feeding restriction signs, without supplementary detail it is insufficient, as it fails to explain why imagery should be included. Interviewee Professor Geoff Hosey (Appendix 9, part 6) explained that conveying a universally comprehensible message using imagery is especially important concerning feeding restrictions, as feeding by the public is one of the biggest problems many organisations face and the consequences of this practice can be catastrophic. In support of this point, interviewee Dr Paul Rees (Appendix 8, part 6) stated that public feeding influences animal behaviour, specifically begging, representing an unnatural behavioural trait. He also added that for animals destined for release from captivity, explicit steps are normally taken so that they do not associate humans with a source of food. With specific reference to the design of signage, Rees (Appendix 8, part 7) argued that ensuring international comprehension is especially important, since overseas visitors may assume that feeding by the public is acceptable if such practice is commonplace in their home country. A contextually aware approach is therefore required to offer legible feeding restriction signs, which address both diverse visitor needs and animal welfare concerns.

Figure 6.33: Feeding restriction sign

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[10] It is accepted that feeding restriction signs are found in other locations, such as in seaside towns with reference to seagulls.

Despite the importance of the topic, interviewee Professor Geoff Hosey (Appendix 9, part 7) pointed out that humour can be used effectively to convey feeding restriction messages. He expanded upon this argument, explaining that as people go to zoological gardens to enjoy themselves they do not wish to be told what they can and cannot do too vigorously; hence humour is useful in this context, whereas it is not normally associated with regulatory signage elsewhere. In terms of empirical evidence, Belfast Zoo was the only case study site which attempted to present amusing imagery to convey a feeding restriction message (see figure 6.34[11]).

Figure 6.34: Humorous feeding restriction sign

Feedback from the case study interviewees offered supplementary detail relating to regulatory signs and the images they display. Comments made by interviewee Dr Paul Rees (Appendix 8, part 8) suggest that smoking restriction signs are more important in zoological gardens than in many other locations, due to high visitation rates for children and the presence of highly combustible materials, such as dry animal bedding. Equally, interviewee John Lloyd (Appendix 6, part 6) indicated that there is less of a requirement for litter disposal signs in zoological gardens, than there is in other outdoor locations. He felt that visitors are more attuned to the fact that litter should be disposed of correctly compared to a typical cross-section of the general public, due to their interest in and respect for wildlife. Therefore, an approach to inclusive design, which considers all regulatory messages to be of equal importance, is ineffective. Smoking restriction

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[11] This sign displays only block capital lettering, which can negatively impact legibility (Steinfeld and Maisel, 2012).

signs were present at every one of the four case study sites, whereas litter disposal signs were not in place, thus empirical findings support interviewee feedback.

6.3.3 Wayfinding

While the need for orientation and navigation is relevant in a zoological context, how this is achieved is subject to distinct influences not found in a typical high street environment. In the final section for this chapter, photographic data and interviewee feedback is presented in conjunction with the results of two case study experiments, to present a substantive illustration of the unique nature of zoological street furniture accessibility, in terms of wayfinding. Experiment results, in particular, offer in-depth evidence of the limitations of an inclusive design analysis, directly addressing the principal research aim.

Current literature emphasises the importance of ample wayfinding information at key decision points (Mitchell *et al*, 2003), due to the complexity of many urban environments (Berger, 2005). Furthermore, on long pathways there is typically a need to repeat wayfinding messages (Calori and Vanden-Eynden, 2015), as well as displaying time and distance indicators (Mollerup, 2013). In opposition, interviewee Peter Litherland (Appendix 4, part 6) suggested that wayfinding signs are less important in a zoological garden than in a city centre location. He put forward the argument that people should explore and wander, thus too many directional signs can detract from the visitor experience. This argument presents a domain-specific rationale for a reduction in wayfinding information for zoological gardens, which conflicts with standard inclusive design praxis.

Expanding upon the notion of a reduction in wayfinding information, interviewee Dr Paul Rees (Appendix 8, part 9) suggested that there are certain species, which will be adversely impacted by a high level of footfall, and as a consequence of this, zoological gardens should position these animals away from main routes. In turn, the point made suggests that wayfinding systems should be designed to reduce unnecessary footfall past enclosures for noise sensitive species, such as the okapi (*Okapia johnstoni*). This domain-specific issue highlights how visitor needs, in terms of sufficient wayfinding

information, and animal welfare can come into conflict, challenging the scope of inclusive design.

For all outdoor locations, too much wayfinding information can cause confusion and uncertainty (Southwell and Findlay, 2007). More specifically, messages should be short and simplistic (Lacey, 2004), with no more than three separate destinations being listed on directional signage (Huelat, 2007). As with much existing wayfinding guidance, these concepts require reinterpretation to be effective in a zoological context. Interviewee Professor Geoff Hosey (Appendix 9, part 8) explained that when directional signage refers to a region or genus, as opposed to listing many individual species, the amount of information on display is normally reduced. His point highlights the relevance of domain-specific knowledge when applying inclusivity principles. Most signs at the Welsh Mountain Zoo, Edinburgh Zoo, and Belfast Zoo (figure 6.35) listed individual species. An alternate approach was taken for some of the signs at Chester Zoo. As shown in figure 6.36, referring to both 'hoofed stock' and 'water fowl', instead of listing many individual species, reduces the amount of information on display and in turn the level of complexity and visual clutter.

Figures 6.35 and 6.36: Directional signage for multiple species

Each wayfinding system should utilise consistent nomenclature (Rose, 2015), taking into account terminology used elsewhere, such as on websites and leaflets (Southwell and Findlay, 2007). This guidance is appropriate for a zoological context, yet inherent complexities render it ineffective without reference to domain-specific concerns. As explained by interviewee Dr Paul Rees (Appendix 8, part 10), terms such as 'super predator' can be interchanged for 'top predator' or 'top carnivore' on signage, posing

confusion for some visitors who are only familiar with one particular phrase. In relation to wayfinding, a directional sign could state 'sloth bear' (*Melursus ursinus*) and an exhibit label could state 'Stickney bear'. Both would refer to the same species, nevertheless, the binomial discrepancy could cause unnecessary confusion due to the use of different common names. The notion of consistency alone is insufficient without an understanding of related terminology, directly influencing the effectiveness of an inclusive design analysis.

Observations at the case study sites revealed that none of the four zoological gardens utilised colour to determine class as part of their directional signage; for example, using red on signs for mammals and blue on signs for birds. This is significant from an inclusivity perspective, as colour coding can be used to communicate function and identity and to surmount language barriers (Imrie and Hall, 2001). However, interviewee Professor Geoff Hosey (Appendix 9, part 9) stated that colour coding by class serves little purpose because most visitors lack a sufficient awareness of the relationship between colour and taxonomy. The argument put forward explains why colour coding wayfinding signage in a zoological context is largely ineffective, delimiting the relevance of an inclusive design analysis. An alternative colour coding paradigm for directional signage was put forward by interviewee Anthony Sheridan (Appendix 7, part 6). He noted that zoological gardens can use colour in geographical terms, using one colour for European animals and another for African animals, for instance. Notwithstanding his suggestion, he highlighted why utilising colour to indicate geographical range is potentially problematic, since for some species habitat range spans more than one continent: the eastern gray squirrel (*Sciurus carolinensis*), for example. Moreover, best practice guidance suggests using no more than six colours within a specific wayfinding paradigm (Wyman and Berger, 2005), yet there are seven continents. Despite the fact that colour coding by geographic range was not observed at any of the case study sites for directional signage, the topic highlights a further related complexity and the need to reinterpret accessibility guidance for the zoological context.

Literature cites maps as a key wayfinding component, to enhance orientation for people of all ages and abilities (Gibson, 2009). Imagery is particularly useful in this context, as it increases understanding for those who cannot read text on display (Berger *et al*, 2005). Observations from the four case study sites revealed that only the Welsh

Mountain Zoo did not display maps for visitors to refer to, and that all of the maps on display at the other three sites utilised imagery. Feedback from case study interviewee Professor Geoff Hosey (Appendix 9, part 10) helped to explore this topic further, establishing the need for a contextually aware approach to imagery provision. He suggested that the drawings on the maps at Chester Zoo had been created by a design agency employing staff who lacked the required zoology understanding to produce the drawings. For instance, it is clear from figure 6.37 that it would not be possible for people to tell if the image depicted a Bornean orangutan (*Pongo pygmaeus*), a Sumatran orangutan (*Pongo abelii*), or if it was designed to represent both. In fact, he stated that this image was poor, as while its coloration is visually descriptive, its physical characteristics make it look more like a type of chimpanzee than a type of orangutan. This case in point explains why an inclusive design analysis is ineffective without an understanding of species-specific detail; thus, the notion of using imagery on maps is insufficient, as it lacks the detail required to implement best practice guidance in a zoological context. However, this does not mean that designers have to have zoological expertise. It is possible to merge inclusivity concepts and zoology by having designers work with zoological staff, or by incorporating relevant data into a design brief.
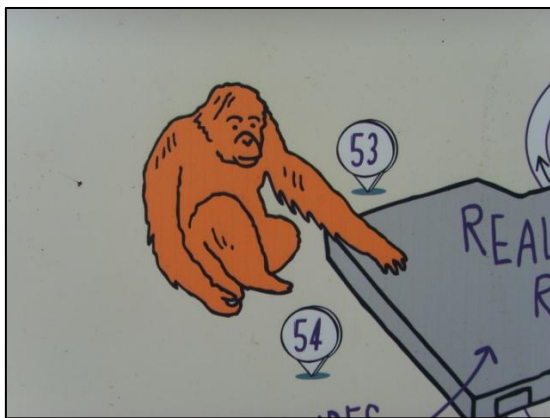
Figure 6.37: Orangutan map imagery

Offering further related criticism, interviewee Professor Geoff Hosey (Appendix 9, part 11) pointed out that the maps at Chester Zoo only display images of more popular species; the site is home to slender-tailed cloud rats (*Phloeomys cumingi*), yet visitors cannot use imagery to locate them. This was a significant contribution, as Huelat (2007) argues that maps should focus attention upon popular destinations, yet using Chester Zoo's maps to find less popular species means relying upon text alone. Interviewee

feedback suggests that applying broad cartographic guidance omits significant detail in a zoological context. At both Edinburgh Zoo and Belfast Zoo maps also focused upon species that are typically more popular.

Although literature advocates the use of imagery on directional signage to instil clarity (Wyman and Berger, 2005), it offers no guidance on which type of imagery to use for different species. Pointer signs for enclosures at the Welsh Mountain Zoo and Belfast Zoo (figure 6.38) were observed to be solely reliant upon text, while their counterparts at Chester Zoo and Edinburgh Zoo mainly utilised pictograms. In particular, the giant panda (*Ailuropoda melanoleuca*) pictogram at Edinburgh Zoo (figure 6.39) functioned as a catalyst for the first case study experiment. Without an understanding of the supporting text, it could easily be confused for a different species of bear, whereas a colour photograph would be less subject to misinterpretation; suggesting that broad guidance to include imagery lacks sufficient detail. The first case study experiment sought to explore this topic further, by gathering visitor preferences to establish the viability of displaying photographs as opposed to pictograms on directional signage, to increase clarity *vis-à-vis* species type. The experiment challenges the work of authors such as Abdullah and Hübner (2007) who champion pictograms as a universal communication medium, whilst also questioning research undertaken by Sakai *et al* (2010), who found that people like animal pictograms on zoological directional signs. The following narrative presents further detail on the experiment alongside its findings, which support the argument that the effectiveness of an inclusive design analysis is highly dependent upon contextual factors.

Figures 6.38 and 6.39: Directional signage for multiple species

6.3.4 Experiment 1

The rationale for the first case study experiment was based upon the argument that photographs can offer an enhanced level of species-specific detail when compared to pictograms, with reference to directional zoological signage. This is particularly relevant when species share a similar symbolic outline with others within their genus. For instance, a pictogram of a cheetah (*Acinonyx jubatus*) and a cougar (*Puma concolor*) look very similar, however photographs of these two animals look quite different. It is therefore clear that for people who cannot read supporting text, photographs can offer enhanced access to information. This argument functions with greater rigour in terms of iconic species, such as the aforementioned cheetah. Conversely, a photograph of a lesser-known species, such as an Indian muntjac (*Muntiacus muntjak*), is unlikely to offer an enhanced level of species-specific detail for a typical zoological garden visitor who is liable to consider both a pictogram and a photograph of this species as an image of a type of deer, and nothing more. Nevertheless, a photograph of an Indian muntjac could be more useful for a zoologist when compared to a pictogram of the same species. Consequently, and from an inclusive design perspective, photographs theoretically increase access to information for experts without negatively influencing information provision for others. They are potentially useful concerning both iconic and obscure species, albeit they are likely to be useful for a greater percentage of the population when considering iconic species only.

Figures 6.40 and 6.41 illustrate the potential advantages photographic imagery presents. When viewing figure 6.40, most illiterate people would only know that the image represents a species of bear. Figure 6.41 would provide this group of users with the knowledge that a brown bear (*Ursus arctosis*) is being represented, so both an illiterate person and an individual who can read the text on display would be privy to the same information, albeit in different formats. The point being made here is also relevant to tourists who visit zoological gardens from outside of the United Kingdom and may not be able to read English text, or for people who have lost their ability to read after a stroke or brain injury.

Figure 6.40: Brown bear (Ursus arctosis) signage (pictogram)
Design by the author using a royalty free pictogram

Figure 6.41: Brown bear (Ursus arctosis) signage (photograph)
Design by the author using photography by Mike Levin

The first case study experiment took place at the Welsh Mountain Zoo, where two new signs were temporarily installed. Figure 6.42 shows the design that incorporated a pictogram, while figure 6.43 shows the design that incorporated a photograph[12]. Participants were asked to state which design they preferred, while also being given the option to explain why. The experiment hypothesis was that zoological garden visitors would prefer a directional sign that displayed a photograph rather than one that displayed a pictogram, as it would require less interpretation, offer an increased level of reality, and be more engaging. The hypothesis was based upon arguments that photographs offer greater detail (Tinkler, 2013) and levels of reality (Binder and Schöll, 2010) compared to other visual mediums, as well as the aforementioned theory regarding an increase in species-specific detail.
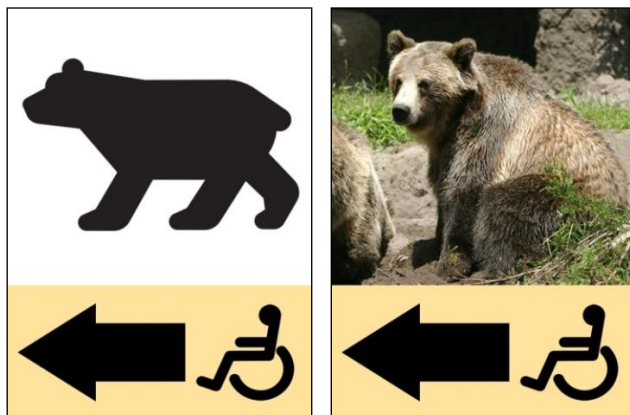
Figure 6.42: Brown bear (Ursus arctosis) directional signage (pictogram)
Figure 6.43: Brown bear (Ursus arctosis) directional signage (photograph)
Designs by the author using royalty free pictograms and photography by Mike Levin

Given the research context, many different species could have been chosen for testing purposes, yet the experiment represents a single case, focusing upon one species. The brown bear (*Ursus arctos*) was chosen because a generic bear silhouette clearly illustrates the argument that photographs offer enhanced species-specific detail, when compared to pictograms. This argument is especially convincing when the brown bear is compared to the polar bear (*Ursus maritimus*), black bear (*Ursus americanus*), or giant

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[12] In hindsight, the use of the international symbol for accessibility on both designs could be confusing for people who would not consider themselves disabled, yet could use, or would benefit from an accessible route; for instance, people with young children. Moreover, the symbol is most commonly used for toilets, which these signs do not denote. During data collection, a passing child looked at the signs and stated *'this way to the disabled bears'* (!) highlighting issues of interpretation.

panda (*Ailuropoda melanoleuca*), due to clear physical differences, which are difficult to convey using pictograms. In terms of practicalities, the fact that the Welsh Mountain Zoo houses brown bears allowed the experiment to relate directly to a real enclosure. The popularity of brown bears with visitors was also of relevance. Some visitors may not have known what a spectacled bear (*Tremarctos ornatus*) was, irrespective of image choice.

Approximately 57% of the people who took part in the first case study experiment preferred the photographic sign, confirming the original experiment hypothesis. Participant feedback suggested that the photographic sign was clearer and more appealing. Many people taking part also stated that the pictogram sign could be confused for another animal. Comments included *'it could be a pig'*, *'it could be anything'*, and *'it could be a polar bear or black bear'*. The experiment results suggest that zoological gardens should now consider using photographic imagery and text on directional signs, rather than pictograms and text or text alone. Not only is doing so theoretically superior in terms of information provision, but in relation to the experiment results it is also preferred by site visitors. More importantly, in terms of the thesis research aim, the experiment offers clear evidence of the unique nature of zoological street furniture accessibility, since in most other locations animal photographs are typically irrelevant in a wayfinding capacity. In turn, it shows how and why an approach to increasing comprehension using imagery is subject to localised environmental factors, which need to be addressed to ensure an effective approach to inclusive design.

Following completion of the first case study experiment, the Welsh Mountain Zoo took the results into consideration by replacing the sign shown in figure 6.44. The new design, by the author, (figure 6.45) includes photographic imagery conveying species-specific detail, irrespective of language comprehension. Additionally, the new sign includes an unambiguous directional arrow, alongside the international symbol for accessibility.

Figure 6.44: Brown bear (Ursus arctosis) directional signage (text only)

Figure 6.45: Brown bear (Ursus arctosis) directional signage (by the author)

6.3.5 Experiment 2

To offer further substantiated evidence of the unique nature of zoological street furniture accessibility, with specific reference to wayfinding, a second experiment was conducted on-site at the Welsh Mountain Zoo. The experiment focus was logo design; more specifically the use of animal imagery as part of logo design. Observations revealed that logos were displayed on signs at all four case study sites. At the Welsh

Mountain Zoo and Chester Zoo (figure 6.46), logos displayed only text, whereas at both Edinburgh Zoo and Belfast Zoo (figure 6.47), animal imagery was displayed. Empirical evidence suggested that animal imagery offered an opportunity to increase comprehension by transcending language barriers. The second case study experiment sought to test this theory in terms of visitor preference.

Figure 6.46: Chester Zoo logo

Figure 6.47: Belfast Zoo logo

The second case study experiment asked participants which of three different logos they preferred. Participants were also given the opportunity to explain their choice. All three logos signify the same fictional zoological garden. The first logo (figure 6.48) was solely text based. The second (figure 6.49) visually hinted at a zoological connection using a distinctive coat pattern, while the third (figure 6.50) clearly displayed an animal image. The hypothesis was that people would prefer a logo that included an animal image, rather than an image offering a subtle visual connection to zoology or a text only logo. Airey (2010) advocates imagery inclusion as part of logo design to aid international comprehension, yet the use of animal imagery is a domain-specific concern, not addressed within current literature.

Figure 6.48: Salford Zoo logo (text only)

Design by the author

Figure 6.49: Salford Zoo logo (visual hint)

Design by the author using royalty free imagery

Figure 6.50: Salford Zoo logo (animal image)

Design by the author using royalty free imagery

Two out of the three logo designs used for the experiment incorporated giraffe imagery. Neither clarified the type of giraffe, for instance, a reticulated giraffe (*Giraffa camelopardalis reticulata*) or a Rothschild's giraffe (*Giraffa camelopardalis rothschildi*). Many different animals could have been selected, however a giraffe was chosen as it is commonly kept in Europe's zoological gardens and it is not found naturally in the United Kingdom. A European badger (*Meles meles*), for example, would not have been a suitable choice, as this creature is native to the United Kingdom, and is not typically kept in captivity. Giraffes also have unique patterning on their coats and this was useful in terms of designing the zoological hint logo.

Experiment results revealed that approximately 81% of participants preferred the logo design that included animal imagery, as opposed to the zoological hint logo or text only design. This suggests that zoological gardens should consider animal imagery to be a key component of logo design. One particular participant comment epitomises this argument; *'I like the usage of an 'exotic' animal to further establish to the viewer that they are looking at a sign for a zoological garden'*. This comment suggests that people not only prefer animal imagery but that species choice is significant and that exotic animals are perceived to be associated with zoological gardens. In terms of the thesis research aim, two out of the three logo designs displayed imagery; yet based upon the experiment results, only one is fitting for a zoological context, due to documented visitor preferences for clear animal imagery. In this instance, the notion of increasing accessibility through imagery is ineffective, without reference to its context of application.

6.4 Conclusion

This chapter has presented photographic data, interviewee feedback, and the results of two experiments to explain the unique nature of zoological street furniture accessibility in the United Kingdom, whilst also evaluating the effectiveness of inclusive design as an analytical tool; directly addressing the thesis research aim. Synthesised data suggests that documented domain-specific issues render much existing access guidance both insufficient and ineffective. For zoological gardens, an inclusive design analysis is a

context dependant and complex process, thus knowledge of both zoology and inclusive design is typically required to increase the accessibility of on-site street furniture. Access guidance must be reinterpreted. However, this is not always feasible due to conflicts between an increase in accessibility for older and disabled people and domain-specific nuances. The findings discussed here also suggest that an inclusive design analysis is influenced by context, not only in the zoology domain, but in other analogous settings as well; therefore the research findings hold broader significance.

Chapter 7

Conclusion

The final chapter for this thesis presents a series of conclusive statements and judgements concerning the research aim and hypotheses; all of which contribute to a greater understanding of inclusive design, thus assisting people of all ages and abilities. In addition, broader theoretical contributions and implications are discussed, regarding the influence of this thesis upon both debate and practice. Finally, a number of limitations and future research opportunities are also examined.

7.1 Aim and Hypotheses

This thesis has established the influence of context upon the effectiveness of inclusive design as an analytical tool, to address the primary research aim. Rather than focusing upon the well documented challenges of user diversity (Goodman-Deane *et al*, 2014), and low capability levels (Clarkson, 2009), it highlights the challenges and conflicts associated with contextual nuances, especially those that are complex. As a result, research findings support the argument for inclusive design concepts to be reinterpreted when applied to a new setting (D'souza, 2004). In spite of documented social benefits, such as increased independent living for older and disabled people (Christophersen, 2009), inclusive design should function as a foundation to increase accessibility, rather than an uncontested universal ideal. Inclusive design is positive in all instances, yet when contextual factors are understood, it is far more effective.

Specifically, research findings have shown that without an appreciation of context, indiscriminately adopting guidance for accessible street furniture in zoological gardens is largely ineffective. Therefore, context should be taken into account when applying inclusive design principles, to allow for domain-specific design solutions, especially with reference to zoological street furniture. Thesis content strongly supports the work of Siu (2008) who suggests that the functionality of street furniture is determined by an appropriate environmental framework. It also confirms that, in terms of street furniture, user needs are shaped by contextual developments (Siu and Wong, 2015).

The ineffective nature of existing guidance for accessible street furniture provision, when applied to the zoology domain, contributes to an existing series of criticisms levied at current inclusive design guidance. All of these criticisms stem from the claim that solely functionalist approaches to increasing accessibility fail to address contextualised socio-political variation (Imrie, 2012). Specifically claims that current guidance lacks reference to practice (Nussbaumer, 2012) and that relevant documents are overly prescriptive and difficult to find (Goodman *et al*, 2007) are both reinforced by the research findings, which subsequently contribute to inclusivity discourse. Current guidance is insufficient as it fails to explain how the accessibility of zoological street furniture can be increased. This finding was particularly acute regarding signage and the use of imagery. Pictograms present an illustrative case in point, as highlighted by the first case study experiment. Pictograms typically function as universally recognisable symbols (Abdullah and Hübner, 2007) and zoological garden visitors prefer signs displaying pictograms compared to text only alternatives (Sakai *et al*, 2010); however, on zoological directional signs they can fail to convey species-specific detail. Despite this, pictograms are currently utilised in zoological gardens on directional signs, presenting an example of supposedly inclusive design, which fails to take context into account.

Figure 7.1 shows that the onager (*Equus hemionus*) pictogram at Chester Zoo only depicts the species monotone outline, and subsequently only its genus, not the distinctive characteristics, which differentiate it from other equines. People who cannot understand the text on display will receive less information than those that do, despite the use of imagery. The argument put forward here supports the work of Barrett and Barrett (2003), who state that best practice guidance must fit its context of application; therefore, it cannot be simply transferred from one environmental framework to another. It also draws into question the unilateral notion that guidance documents irrefutably help designers to understand and address accessibility concerns (Clarkson *et al*, 2007).

Figure 7.1: Onager (Equus hemionus) directional signage

Concerning the secondary element of the research aim, thesis output has documented and explained the unique nature of zoological street furniture accessibility in the United Kingdom, through an examination of empirical findings. Figure 7.2 presents an example from Belfast Zoo, highlighting signage content that would only be found in a zoological garden. In terms of inclusive design, increasing the percentage of the population who can comprehend species distribution maps is an access concern limited to the zoological context. Examples given previously in this thesis demonstrate why the street furniture in zoological gardens is different to that found elsewhere and why related access issues and design solutions are also different. This finding contributes to the argument that a consideration of context should be an integral component of any inclusive design analysis.

Figure 7.2: Cheetah (Acinonyx jubatus) species distribution map

With reference to current practice, research findings suggest that accessibility guidance for street furniture is not applied to zoological gardens without a process of contextually aware reinterpretation, involving input from zoologists. Ideally, a tailored document offering contextually relevant inclusive design guidance, specifically for zoological gardens, should be produced. Findings also contribute to the broader proposal that applying generic access guidance in analogous outdoor locations is inappropriate, without an in-depth appreciation and understanding of milieu, which may usurp the assertion of inclusive design.

All of the three original hypotheses have been tested by the research process. Firstly, it was hypothesised that conducting an inclusive design analysis for this thesis would be challenging. Documented conflicts of interest and a lack of fit between inclusive design

and an amalgam of zoological nuances indicate that the process is highly challenging. Conflicts of this nature are exemplified by animal-themed street furniture, given that clarity of function and the need for visitor entertainment come into conflict, as illustrated by figure 7.3 from the Welsh Mountain Zoo. The conventional use of Latin on exhibit labels and comprehension for the lay audience presents another representative conflict. Moreover, investigations have found that the needs of site visitors and captive animals can come into conflict, challenging the effectiveness of inclusive design; the position of seating, with visitor viewing preferences in mind, can distress some primate groups, for instance[13]. Examples such as this underpin the need for a contextually aware approach to increasing the accessibility of zoological street furniture, as well as supporting the idea that access priorities vary depending upon context (Preiser, 2009).

Figure 7.3: Animal-themed litter bin

The second hypothesis originally posed was that zoological street furniture is not fully accessible. The quantity of access issues discussed within this thesis, such as a lack of regular seating, provides substantiated evidence to support this proposal. Findings also highlight the importance and value of this research area for older and disabled people, as well as supporting claims that inaccessible design is a widespread problem (Keates and Clarkson, 2004), especially regarding street furniture (Newton *et al*, 2010). This was essential, as had zoological street furniture already been fully accessible, the scope for developing a heightened understanding of inclusive design would have been diminished, due to a lack of conflicts of interest, which ultimately allowed for an in-

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[13] This example is also useful as it illustrates how this thesis extends to design that considers animal welfare as part of the inclusivity spectrum.

depth evaluation of the influence of context. A lack of Braille, attributed to the visual nature of the visitor experience, represents a useful illustration of inaccessible design and a divergence between inclusive design best practice and the inherent nature of zoological gardens.

The third hypothesis was that domain-specific access issues would exist due to the presence of captive animals. Research findings have shown that when zoological street furniture accessibility differs to that found elsewhere captive animals are the primary cause. Reasons for this were diverse, ranging from signage content focusing upon natural history, to animal welfare concerns influencing a proposed approach to litter bin design. Consequently, inclusive designers and zoologists are required to work together to form contextually responsive and appropriate design solutions, which cater for the needs of both site visitors and captive animals. Species-specific information should be sought out, as appropriate design solutions vary depending upon species type; for example, the scale of distribution maps, and resultant clarity and comprehension is dependent upon the habitat range of each individual species. Findings supporting the final hypothesis show how the fundamental nature of an environmental framework has a scope of influence extending to the accessibility of the built environment. Based upon empirical case study findings, the author has formed the following definition for zoological street furniture, to differentiate it from that found in other locations:

The term zoological street furniture refers to items of street furniture located within zoological gardens, including most commonly: seating, litter bins, and signage. It implies the presence of artefacts that are intrinsically linked to a zoology context, such as exhibit labels, while concurrently implying the omission of installations that are seldom found on the grounds of a zoological garden, yet would be found in a typical high street; post boxes, for example.

A final yet significant contribution is that the two case study experiments have proposed design solutions, supported by visitor feedback, to increase the accessibility of zoological street furniture; therefore, zoological gardens can now refer to a small quantity of domain-specific guidance. The results of the first case study experiment suggest that zoological gardens should now consider using photographic imagery on directional signs to increase comprehension of species-specific detail. Similarly, results

from the second experiment suggest that all zoological logos should present animal imagery as a central component, to transcend language barriers.

7.2 Limitations and Future Research

Due largely to the part-time and self-funded nature of the research, a number of limitations require attention to both acknowledge inherent restrictions and to explain their implications. This section details such limitations and points towards several future opportunities for academic output. Significantly, all of the research limitations present opportunities for future research endeavour. Existing shortcomings serve as a foundation for knowledge creation.

Although both case study experiments gathered feedback from a wide range of participants, inclusive of older and disabled people, specific feedback from this group of end users has not informed thesis output. One possible implication of this is that the research may benefit from additional insight into the needs and aspirations of older and disabled people, with specific reference to zoological street furniture accessibility and service design[14]. Future research could address this issue, by employing any one of a series of inclusive design tools and resources which facilitate direct end user feedback; activity diaries, for instance. In addition, a similar approach could be taken to gather more feedback from people representing different cultures and ethnic backgrounds.

Both of the case study experiments focus upon participant preference, not comprehension, highlighting a research limitation. Future experiments could address this knowledge gap. Specific possibilities are copious due to species diversity and an abundance of accessibility concerns. Yet developing the first case study experiment further presents an illustrative example; people could be shown pictograms and photographs of different species of bear and asked to state which species is on display. Doing so would draw further attention to the unique nature of zoological street furniture accessibility, due to the use of bear imagery. Additionally, such an experiment would inform future signage design and further challenge existing inclusive design concepts

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[14] Additional insight regarding the impact of service design helps explore the linkage between product design and service design, and how this can influence accessibility (Bichard, 2015).

regarding the universality of pictograms, should participants identity species type with greater ease when viewing photographs. However, it is possible that a bear pictogram alongside a snowflake pictogram is as lucid as a corresponding photograph of a polar bear (*Ursus maritimus*). Nevertheless, participant feedback would be required to confirm this conjecture.

On account of ethical concerns, and to place boundaries upon the study, research undertaken for this thesis does not specifically address inclusive design for young children. Therefore, direct insight concerning their needs and aspirations is lacking. Reference is made to this topic through relevant discussion regarding reading ages and entertainment, but it has not been a central focus; rather the topic has been referenced as and when it served to contribute towards the research aim. This is relevant due to the popularity of zoological gardens with young children (Rees, 2011). In particular, research relating to playground equipment accessibility in a zoological context presents a future and distinctive topic for possible exploration, which could build upon the research that has already been undertaken for this thesis.

Given the likely ongoing advances in technology, for street furniture in general, and signage in particular, future developments will no doubt pose opportunities for related research. This will likely present a challenging area for academic endeavour, as the application of new technology will need to take into account accessibility for older and disabled people, in conjunction with zoological nuances. In terms of inclusive design, there is a clear need for research in this area to address concerns that new technology will alienate marginalised users from accessing the important conservation message that zoological gardens convey.

In closing, two concepts to develop knowledge in this area further are outlined. Firstly, in relation to the use of inclusive design as an analytical tool, it is proposed that an equivalent study is undertaken in another nuanced set of locations, such as a series of theme parks or botanic gardens. Doing so is likely to reveal further conflicts between inclusive design best practice guidelines for street furniture provision and nuanced environmental factors, which will ultimately contribute to and sustain the argument that the realisation of inclusive design is subject to a comprehensive understanding of context. Secondly, developing an extensive understanding of how to design accessible

signage for a specific species will highlight the unique nature of zoological street furniture accessibility in greater detail, as well as explaining how to increase accessibility for visitors. In turn, inclusive design challenges associated with one species will serve as a bellwether for related studies concerning other diverse species. Owing to the basis of the first experiment, a focus upon bears represents a rational starting point. Future study could look at the specifics of accessible exhibit labels and directional signage for brown bear (*Ursus arctosis*) enclosures, inclusive of further visitor feedback. Such an undertaking would function as a direct response to Sheridan's (2013) request for zoological gardens to respond to the needs of foreign visitors through accessible signage, and develop by carrying out extensive visitor surveys.

7.3 Conclusion

Accumulated research findings present two distinct judgements; the first relates strictly to the zoological context, while the second has far broader implications for inclusive design practice. Firstly, by explaining the unique nature of zoological street furniture accessibility, thesis output argues that accessibility is greatly enhanced when both inclusivity and zoological nuances are considered simultaneously. Applying inclusive design best practice guidelines for street furniture in a zoological context, without a process of reinterpretation, results in ineffective design solutions, yet when domain-specific concerns are taken into consideration it is possible to increase accessibility for a wide spectrum of users; despite significant and challenging conflicts of interest. Secondly, the abundance of conflicts between an increase in accessibility and the zoological domain suggest that similar issues will curtail the influence of inclusive design in analogous environmental frameworks; hence, the effectiveness of inclusive design as an analytical tool is dependent upon an understanding and appreciation of context. Both findings at the micro and macro level represent an original contribution to knowledge. Addressing both components of the research aim contributes to a greater understanding of inclusive design, thus enhancing an existing framework to improve the lives of people of all ages and abilities, especially older and disabled people. In addition, the thesis contributes to inclusive design case studies of specific environments, and can therefore be used as a comparative or supportive tool.

This chapter has also outlined a series of limitations and future research opportunities. To address these shortcomings and to develop the subject area further, future research, which builds upon the contributions of this thesis, will subsequently be undertaken by the author. It is hoped that other interested academics will conduct related research as well, either independently or collaboratively with the author, allowing for an influx of new ideas and perspectives. Both inclusive design and zoological street furniture accessibility, as independent topics or in unison, present exciting opportunities for further study, due to the wealth of existing domain-specific access concerns.

Appendices

Appendix 1: Research Project Agreement Form for the Welsh Mountain Zoo

The following agreement outlines the conditions under which the National Zoological Society of Wales will host student projects at the Welsh Mountain Zoo (or occasionally other sites). In most cases these will be science projects, but this document should also be used for other projects, e.g. part of arts or media courses etc.

A copy of this document must be signed by the student and returned to the Zoo office in advance of starting the project.

1. Before approval will be given for a project to be conducted at the Welsh Mountain Zoo the student must:

a) provide the Zoo with name and home address of student, details of educational institution attended (university/college) and department, course taken, name of project supervisor, written project summary/synopsis.

b) arrange for the project supervisor to provide written confirmation of the student's *bona fides* and of support for the project as outlined in the synopsis. Ideally this should be on University/College letterhead, but by email will be acceptable.

In some circumstances, e.g. a complex science research project requiring more staff time than usual, the Zoo may insist that:

c) the project is approved and supported in advance by the BIAZA Research Group www.biaza.org.uk

Either way, for science projects, we strongly recommend that students visit the website and make themselves familiar with BIAZA's research guidelines. This section of the website contains some very useful guidance on putting together your project.

2. During the project work the student must:

a) comply with all public and staff health and safety regulations and procedures in the Zoo and follow any staff instructions (all students carrying out projects on site are covered by the Society's Employers Liability Insurance).

b) comply with all animal welfare regulations and procedures in the Zoo and follow staff instructions.

c) only be on Zoo premises at agreed times (this may include when the Zoo is closed to the public) and always report to the office or a senior member of staff on arrival.

d) only enter off-show areas (i.e. staff-only areas) for which specific authority has been given (access to public areas will not be restricted).

3. On completion of the project the student must:

a) inform a senior member of staff of the last day of attendance on site.

b) provide the Zoo with a copy of the written dissertation as soon as available.

c) inform the Zoo if there is any intention to publish the project.

The student must sign below to confirm understanding and acceptance of the above Conditions:

Print name: Michael David William Richards

Signed: Date: 19/11/2010

NATIONAL ZOOLOGICAL SOCIETY OF WALES

Nick Jackson

Zoological Director   Updated 01/02/2010

Appendix 2: Interview Questions for Peter Litherland

1. Please describe how the following topics influenced your response to the case study?

- Concerns over legal compliance
- Empathy for older and disabled people, your own personal experiences and apprehension about your own future
- Moral issues
- The needs of the zoo's employees
- The increasing spending power of the world's ageing population
- Your own personal interest in design

2. Which aspects of the case study do you disagree with?

3. Which aspects of the case study have been the most enlightening?

4. What changes (if any) do you foresee as a direct result of this research?

5. Cost aside, do you have any reservations about installing more accessible alternatives to the zoo's existing street furniture?

6. How has location specific legislation influenced your decision-making in relation to the zoo's street furniture?

7. In what form would you prefer to receive accessibility guidance in the future?

8. What steps should be taken to develop the case study further?

Appendix 3: Interviewee Quotations: Nick Jackson

This appendix provides verbatim quotations from the interview with Nick Jackson. Quotations are listed which are relevant in relation to the research aim, including all those referenced within the main thesis text.

1) Where the different categories of warning, or trying to alert people to issues, this is something you'll know more about than I will, because some of these things may have a legal implication, about the colours used. If everywhere we thought there was even the slightest, a sign that says careful you might slip, or step here, or steps, or whatever; if every sign we did was bright red I have to say the zoo would probably be full of bright red signs. It loses its meaning and it also starts to detract. But the point is if the zoo is full of red warning signs, and this that and the other, I can feel it being to the detriment of the zoo. So a balance has to be struck. The homemade signs round the zoo, and you do make a point about homemade, which I wouldn't argue with, but some of them where we are trying to gently warn people of a possible hazard, I think we're using a yellow background; black print on a yellow background as opposed to bright red. And again I don't know really the answer to that issue other than I don't want to go down the road of too many signs all over the zoo. And I don't want to go down the road of signs that we do have are too high a proportion of them are brightly coloured and so there is a sort of, it's an aesthetic thing really and it's balancing against the need to warn people obviously of a possible issue. What it entails in terms of the design, if that's the right word, but in terms of the ambience, the aesthetics of walking round the zoo and looking at the zoo. Can we improve it in terms of best practice and those concepts, at the same time, not to destroy something we've got already? So it's a bit like the issue we said, if we have too many signs or there're all bright red, or even litter bins if they're all too brightly coloured or whatever it may be. The reservations to use your word would just be about design and ambience.

2) There's a sign at the penguins which says don't 'touch the penguins', because it can be harmful. Now that was very carefully worded so that it's actually ambiguous, deliberately ambiguous, because it doesn't say who it's harmful to. The primary, if not the main issue, is that it's harmful to the penguins. So in that sense it's not a public

warning sign from a public safety point of view; penguins have been known to peck, I don't think ours have ever pecked anybody. But they have been known to peck, it's not a dangerous thing, they can't peck you in the face, peck you in the eye or something. So it's not really a public safety issue, because that's why, it's physically possible to touch them if people are going to do that, but we don't want them to. And so what we've tried to make clear is that it's harmful to the penguins and they can interpret that it might be harmful to them if they want.

3) It [the site's bilingual policy] has introduced a whole new element to some of the problems and issues we have because, for instance, if we do a label, an information sign, financial resources mean that the size of that label and the amount of information on it is limited obviously. And in fact, because we have a bilingual policy on our labelling there is half the information we would otherwise put on it. The alternative is that we have labels twice the size and again going back to the issue of too many labels and too big labels; so it has had an impact on what we can do and what we can say. And so you could argue our guidebook since 1973 or whatever it was, it could have been half the size and cost half the amount to produce or because if we just did it in English. So sort of basic issues like that which have been a consequence of our bilingual policy, but it's never caused us for a moment to question it or doubt it.

4) Being a mountain zoo and there being accessibility issues generally, it [accessibility] is something we are very conscious of and obviously the older and disabled sectors of the community are the people that we are concerned about. So we're always conscious of that, it is a high priority; it is something we are very conscious of. It's almost a daily occurrence that we will get a phone call saying we want to come to the mountain zoo but what's accessibility like, how much of the zoo can we see from a wheelchair, all those sort of issues.

5) Whenever we do anything new, we always look at accessibility. For instance, when we did the sea lion development some years ago, we bought in a local group of people using wheelchairs to look at accessibility so that we can try as best we can depending on which part of the zoo we make a development. But whenever we can, when we redevelop a part of the zoo, we put in the appropriate accessibility features, whether it's

ramps or whatever it is, because of course we're on an old Victorian estate with lots of steps and slopes and things, which make it difficult.

6) The frustrating thing, one of the most frustrating aspects of this job working here, in that sense, is that we are a relatively small setup. And so the scope, there's quite a lot of scope for imaginative, coping with issues, spending the least amount of money, and for that you do sometimes need to be creative but there just hasn't been the capacity to experiment a bit or expand a bit or bring in novel ideas. Not just straight forwardly about cash availability to spend, but in a large sense it's about time, it's about my time as an individual, but it's also about having other staff with the time to devote to these issues. So we look, I suppose my main input or my main, in terms of design, in terms of an interest in design, comes when we are developing a new exhibit or a new area of the zoo. And that's not just about animal enclosures, but it's about access pathways, it's about all the issues and I hope I always can make time to have an input into that process.

Appendix 4: Interviewee Quotations: Peter Litherland

This appendix provides verbatim quotations from the interview with Peter Litherland. Quotations are listed which are relevant in relation to the research aim, including all those referenced within the main thesis text.

1) Also the public obviously drag the benches round. If there is a large group of them, they will drag the benches round and you quite often see the benches down at the sea lions, where the windows are for the pool, there're nearly always pushed against the fence to start with and they gradually get closer to the glass; and that's public, that's not us.

2) So sometimes you think well that's been stuck in the middle of nowhere, but then people have asked for it, particularly the benches. I don't know whether you've seen the benches round here, but quite often they've got name plaques on. So they've been, well they've asked for the bench to go there, or their family have because of the view, or because, it was half way round the zoo or for whatever reason. They sponsor a bench and I think I've only noticed that going on in the last six or seven years. And I think it seems to be quite sort of popular, so the ones down at the lemurs are definitely. I think there are a few, have got the plaque on it, you know 'spent many happy hours here' or whatever it is. It is better if you can recess them or put them off a path, sometimes you can't.

3) Sometimes it's easy to get carried away in a subject that you're passionate about, and you want to be descriptive about something, but for most people it's not a passion so you've got to keep it [exhibit label content] punchy and simple. As you will know better than me, I think there's been loads of studies done about how long people read a sign for, and I think the answer is never long enough. I do, I'm really boring, I'll stand in front of a sign if I'm interested and read the whole thing and even take a photo or make notes, but I don't think there's many people like me. So no, it's got to be to the point, punchy, and not strain people to try and work out what it's talking about.

4) Common names don't really mean a lot, even between, ok we all kind of know what a zebra is or what a tawny owl is, but you know there are a lot of common names that don't really mean; I don't think common names mean a great deal, to be honest with you. Most things will have two or three common names. Ok, things like a blackbird haven't, but I know a lot of people that call them thrushes, because it is a thrush, but there's song thrush, blackbird, mistle thrush; there's quite a few thrushes. Particularly foreign birds, so say there's an owl from New Zealand that I would call a morepork because that's the name that I kind of heard a lot when I was in the bird of prey scene. But they're also called New Zealand hawk owls; they've got about three or four common names. The scientific name, if you're that way, at least you can go away and look it up, whereas a common name you can't really.

5) My bugbear is, and I think we are one of the best zoos for it, is the signs on animal cages telling you what it is. I've been to so many zoos, good and bad, big and small, that I'm looking into an aviary and I know that there is waxwings or common bulbuls, whatever, and there's not a sign for it. Or occasionally there's stuff in it that I don't know what they are and there's not a sign for it either. I want to know, because I don't know every animal, I don't; I wish I did. And like you're looking at some little brown little wader; is it a dunlin, is it a snipe, is it a wood, whatever, and it's nice to know. So not only a little thing to tell you what it is and where it comes from and endangered, but a picture of it so, 'ah that's what it is'. Because there's a lot of little brown [birds] you don't have a clue what they are, they all look the same. And waterfowl, especially when there're out of colour, because all waterfowl, virtually all waterfowl, for nine months of the year, just look brown; they have an eclipse plumage when all of the males, even like a mallard, will drop all of its feathers and looks like a female almost. It's a much duller version. Not all ducks do it, but most do it. So when you're looking at a duck, or like say a wader, you don't always know, I don't always know, what they are.

6) In fact, it would be much nicer if people just walked around, and sort of got lost a little bit.

Appendix 5: Interviewee Quotations: Graham Garnett

This appendix provides verbatim quotations from the interview with Graham Garnett. Quotations are listed which are relevant in relation to the research aim, including all those referenced within the main thesis text.

1) The seating is metal; I wouldn't describe that as being best practice. It's a material that can be hot to sit on in the summer, cold in the winter. The ones with arm and back rests, but if it's timber, and where you can have lateral transfer and that kind of thing and then suddenly you've got a good example.

2) We try to make things as inclusive as possible. We try to make sure, for example, that people of varying ages will be able to read and understand. For people who maybe English might not be their first language, we try to make sure that the information would be suitable for them. What you want to do, you want to make sure that the information on things like interpretation panels is as accessible and usable to as many people as possible. In terms of providing information to various groups in different formats, zoos, any service provider, but in the case of the zoo, they can provide guided tours where experts, the zookeepers, could actually give that extra information as part of their tour. You could do things like guided tours, audio described events, live commentaries for blind people. Not everything needs to be on that panel. It's about having a wide range of communication methods, media, formats, so that you're providing the information in a range of ways to suit different people. The same way that even if you provide information in a very basic form on your panel it might not be suitable for a seven year old, so you would need to have that verbal explanation, as well as what's written down. Basically, you can't please everybody with panels, but you have to try and please as many people as you can.

3) We have the wooden sign, with the red lettering; caution. It's in upper case, which is difficult to read by some partially sighted people, some people with learning difficulties. It is quite legible, we can read it, but if we're focusing on disabled people using it then you probably say, well it doesn't comply with RNIB. RNIB says don't use solely upper

case, don't have things centre aligned, it should be left aligned, and also don't have anything underlined.

4) Unless you actually talk to disability groups, get people's opinions on things, you could be getting things wrong and getting them wrong all the time. And if you've got say one particular bench or one particular type of sign and you're getting that wrong all over the zoo, it's an expensive mistake to make. They [Chester Zoo] might even establish their own disability forum of people who are passionate about the zoo, it could just be residents, it could involve staff, volunteers, it could involve a lot of people.

5) I'm a big supporter, advocate, of the principal of least restrictive access; not too sure if you're aware of that. And that principle, it's all about, if you can't make something fully accessible, make it as accessible as you can. So if you can't provide a ramp because of space restrictions, then how can you make those steps more accessible, how can you, can you provide better handrails, can you provide colour contrast on the nosings. How can you make things as least restrictive as possible?

6) There's the age old issue around providing Braille on panels. If you provided everything in text and everything in Braille then your panels would be massive; they'd spiral out of control, the cost would go up. So quite often when there's Braille on signs it's only very very minimal basic information. It isn't always everything that's written down.

Appendix 6: Interviewee Quotations: John Lloyd

This appendix provides verbatim quotations from the interview with John Lloyd. Quotations are listed which are relevant in relation to the research aim, including all those referenced within the main thesis text.

1) You see I have a great problem with vulgarity, as in the Latin, with vulgar meaning of the people. You can see what is happening here, and similarly with these [animal-themed litter bins], they can be quite vulgar by their very nature, there're Disney. So I think the citing of them has to be very very careful. And that's as much to do with the park element, that it's great for the kids who are Disney, but when you get to my age, you don't have that sense of fun. You want to have the, you want things a bit straighter. So it seems to me as long as we can put things in what appears to be as good as place as possible, there's not necessarily a right place or a wrong place. But there's probably an appropriate place and an inappropriate place. So just as you cite bins around your food outlets, particularly importantly, you need to cite your bins around your picnic areas as well. And, for example, at the top of the hill we've got a picnic area. Obviously they've got to be somewhere where they can be seen, there's no point just hiding them behind a tree, but on the other hand it seems to me, you have to look at your site very carefully and say well 'that can take Disney, that can't'. And I use Disney as a shorthand; 'that can take Disney and that can't'. Perhaps the chimp wood sculpture, at the front, on the way into the Budongo, where the chimps are. That's got that sense of fun, elegance and fun. It is what it is, but because it's wood; if that were plastic it would be the most dreadful thing you could imagine. It would have the same effect. People would, it would open the way up, people would know that there're now going towards the chimps. People would sit, people would have their photograph taken. But it would just be so wrong in front of that multimillion pound, beautifully built, wonderful enclosure, where these animals have a natural quality and they have a, the whole thing is designed, as different spaces and different air conditioned rooms and all sorts of things. So again it's a brilliant bit of science, wonderful research centre. So if you put Disney at the front of that, what are you saying before people get in. But if you use a wood sculpture, like we have it still has that sense of fun, but there's an elegance about it and an appropriateness

based on the material. And I think it's increasingly we think about material and presentation material.

2) What is appropriate, and we're back to the furniture. Disney may be appropriate in that corner, but not in that corner. In that corner, we want beautiful wood handmade craftsman objects. And again we're very good here, or sorry we have been very good. We probably need to look around again properly to be sure how good we are. In using natural materials and generally just sort of creating, you see the decking, for example, is appropriate. It's appropriate, it's natural materials, which is good because we do have a very strong recycling element and being green is important to us because we are a conservation organisation.

3) I like the creative elements, I like to have sculptures around, I like, you know there's the monkeys at the Budongo, it's that wooden carved seat. You see, rarely do I see a family pass by, or a couple pass by, but that they take their photograph there. You see that to me is the right sort of interaction; there're just about to go and see the chimps, the real thing, where there's some brilliant brilliant science going on. And that's a really important thing about this, all zoos, but this zoo is particularly good at science. The idea that you have this lovely carved seat, which opens the experience; you're on the way in, you've already opened the experience up to the visitor. And by making it useful, it's a seat, it's even better, so it has, it's a seat, it's a feature, it's a backdrop for photographs. People pose, literally pose with the chimps, pull faces, and sit like the chimps sit, and all that sort of thing. And that enhances the experience. You want to provide for grandparents bringing the children, parents bringing, and mums, and we've got a lot of young mums in Edinburgh, who take out a season ticket and meet here for coffee and chat; and the kids can play.

4) You have to have closed bins, because seagulls, birds generally, are going to be scavengers in a public place like this. The thing is because in any public place you've got a problem. Seaside has more of a problem than a town, for instance, an inland town. We have a particular problem because once you have animals then your local wildlife comes in and does exceedingly well. So consequently they'll go into the enclosures and pick up and scavenge food, seeds, meat, whatever because of the public doing what the public do and because we have food outlets which helps to raise money. So there's two

aspects of the food outlets, perhaps we can talk about that as well in terms of furnishing the zoo. But the important thing is we want to give people a full day out experience. They can picnic if they want to, but a lot of people don't, as part of the experience is, well, eat out, we'll have a drink and whatever.

5) Well it's a problem [reading ages on signage]. As I said, I've spent my life being a communicator; started life as a teacher and then I went into journalism and then writing and so on, so telling stories, getting people to see your information in some way, shape, or form. I think you have to do a little bit of everything. So we're on the ship and we say, 'on the starboard side to your right, ladies and gentlemen, on the port side to your left, ladies and gentlemen'. And you just have to do that, so you say, 'carnivores, meat eaters, brackets meat eaters, or dash meat eaters', and then you've told the story.

6) On the whole, we are very fortunate in how people treat the park. We don't have a major litter problem. People who come to the zoo seem to understand that you dispose of things properly because of dangers to animals.

Appendix 7: Interviewee Quotations: Anthony Sheridan

This appendix provides verbatim quotations from the interview with Anthony Sheridan. Quotations are listed which are relevant in relation to the research aim, including all those referenced within the main thesis text.

1) This business of ample outdoor seating I think is really important; and most zoos don't have it. The amount of outdoor seating in most zoos is totally inadequate in my view, particularly round those exhibits that people want to sit and watch. With the improvement of outdoor enclosures for monkeys and apes, for instance, more people now want to sit outside and watch these and they need seating and in most places it's not adequate. If there're in a traditional cage, in an outdoor cage, just literally a cage, most people are not very keen on sitting and watching. They like to see them without barriers, without cages, and then they really like to watch them and the animals climbing up trees, and ropes, and ladders and whatever else it may be. A lot of people like to actually see that, and watch them maybe for quarter of an hour, maybe for five minutes; I'm talking about active animals. And monkeys and apes are good examples if they are given free space where people can photograph them, and they can watch them.

2) One thing I notice about litter is the zoo directors who go around with me pick up litter themselves; they will not tolerate it if there's some lying around. There are certain zoo directors, quite a lot, who, as a matter of course will pick up litter as they go round. And if they see anybody dropping any will immediately go to them and say why have you dropped this, there's a litter bin there. Cleanliness in general is a very important issue in many zoos, because of disease.

3) Braille on a sign, I've seen very little of that. I don't know, if I were a zoo director, I always try to put my position, and myself in that position. I have been managing director of a company of 250 people. I've got a lot of management experience and that's one of the reasons maybe why I've had success in getting to know zoo directors in big zoos. But Braille, blind people and Braille, I would have thought is something that they're unlikely to spend their money on to put on signage. They may be able to help in other ways, but to be quite honest I don't know the number of blind people or people

with visual problems who come to a zoo. I really don't know; the zoo experience is very much a visual experience and I would have thought, but I'm maybe wrong, that the percentage of visitors who would benefit from it being in Braille is so small that it would be difficult to justify economically. I'm not trying to be unfair to these people because I'm very conscious of handicapped people. I've just been to Rostock and Hamburg last week and, a lot of people in wheelchairs, a lot of people disabled, and I've noticed that in zoos. For handicapped people who are not visually handicapped, but are handicapped in other ways, a zoo is often a very good experience. I'm quite surprised at the high proportion of people I've seen in wheelchairs, on the continent certainly and probably here to. It's therapeutic to a lot of people, but for people who can't see the main therapy is not there.

4) If there is a world map [displayed on exhibit labels], it should be very small. The main thing is to have an enlarged map of the relevant area because there are many species that come from a very very small area, and if there's a world map, there's a little dot on there, which you may or may not see. Much more importantly, if it's in Africa, which is typical, a lot of the species have a map of Africa with the area and not the world map because the vast bulk of people, maybe everybody, will recognise the map of Africa, that it is Africa, they can say 'Africa'. They don't need the world map to show where Africa is, because I've found in many cases with these world maps you peer and especially if it's sunny and it's difficult to see, you can't see even where the dot is; very poor. It's fine if it's a wolf or a thing that is over a very wide area, but it's not fine if you're looking at a Rothschild's giraffe, that comes from a tiny little bit of Kenya.

5) I probably wouldn't do that [use imagery to underpin Red List data] because there would be so much controversy amongst the zoologists about which animal to have in these different places. The idea I understand. I think as long as it's quite clear where the most critical is. They usually have a colour coding here, rather than just this very large blob. There's usually a sort of thermometer with different colours going along the mercury. So I think as long as it's very easy to determine whether it's good or bad; and red and green, most people understand red as being the worst and green as the best, like traffic lights. I would favour using colours, and very clearly, nothing complex, very clearly, so that people could say 'oh yes it's obviously not very endangered', or 'oh yes it's very endangered'.

6) If I was doing it [categorising wayfinding signs using colour], I would colour code by geography, continent. So have the European animals one colour, the Asian another, the African another. There are quite a few zoos doing this now. Where they've got these so called geo-zoos or they're aiming at geo-zoos. And then they have Africa as one colour and in all the signs for all the animals for Africa have got green all over them. I favour the geographical colour coding of signage. There are not many species that go across these continents; the brown bear is one yes, the wolf is another, there're not very many.

Appendix 8: Interviewee Quotations: Dr Paul Rees

This appendix provides verbatim quotations from the interview with Dr Paul Rees. Quotations are listed which are relevant in relation to the research aim, including all those referenced within the main thesis text.

1) You can have waste that attracts birds, and a lot of zoos, for instance, Blackpool attracts a lot of seagulls. I know in the past there have been seagulls further up the coast around the Barrow area with botulism that were feeding on the waste on the tip there, so potentially you could have birds [defecating] in the water in the penguin pool or anywhere else that could contaminate food. Just access to zoos by small birds can be a problem because they can be passing on disease, contaminating the food. Some outdoor enclosures have actually got wires stretched over the top, not a complete top, but wires, particularly to deter birds of prey coming down taking meerkats and things like that. Pest control in general in zoos is a problem, and you often see rat traps around, like the sort that we have in our car park around the university.

2) When it starts to get like that [an overflowing litter bin] and there's food waste, you're going to end up with wasps and you've got children and wasps and it's often quite unpleasant. And I've seen some zoo restaurants with wasp traps around, specifically because of that, hanging from the buildings and around the edges of the sort of outdoor eating areas.

3) And I imagine if you're in a wheelchair just that action itself [lifting a litter bin lid] is difficult isn't it because it's pulling above yourself.

4) My feeling is always that relatively little of the signage helps the zoos in terms of the public's perception of what they do, because so much of it is aimed at children; like stand next to this image of a giraffe and see how tall you are, or open your arms and see how far you can stretch compared to an albatrosses wings. But relatively little about the fact that zoos help the UK comply with their obligations under the biodiversity convention, for instance, or very little about how zoos exchange animals. And going to

one zoo, seeing which animals they keep and how many they've got, doesn't show you how they fit into the bigger picture of captive breeding programmes across Europe.

5) I suppose for the general public, I'm horrified, whenever I show students a map and point to somewhere in the world and they give me a country that's in the wrong continent. So I suppose for the general public that that's perhaps the most helpful map because most people recognise that as a map of the world. And I suppose if you gave them a picture of just the tip of Africa, without any context, they might not appreciate where that actually is. It would effectively be a series of smaller distributions that you would really be looking at.

6) Sometimes you'll see in zoos signs saying anyone caught feeding the animals will actually be removed from the zoo, to try and emphasise how seriously they take it. And you've got the other sort of signs again that you've referred to that talk about the animals being on a proper diet and it can harm them. When I was a kid I remember, well it changed the animal's behaviour, because they would beg for food; chimpanzees would hold their hands out, because they would expect to be fed, bears would stand up on their hind legs, expecting you to throw food in. Although those bad behaviours have gone since food has been banned. If they were raising animals that they were expecting to be releasing, for instance, then often they would do it in such a way that they couldn't see the source of the food. So there is a long history of using puppets to feed young animals when they're being reared; puppets to feed Californian condor chicks, with basically a glove puppet, so it looks like a mother's head.

7) It could well be a problem [text only feeding restriction signs] in relation to overseas visitors because in a lot of the zoos elsewhere they do allow people to feed.

8) Especially as, of course, zoos attract small children, so there will always be children about in zoos. I was just thinking about another reason why smoking isn't a good thing; there have been some serious fires in various zoos around the world. Of course, there's a lot of combustible material with the bedding in some animal houses where someone could throw a cigarette and start a fire. They had a fire in a house in Paignton Zoo, it was shared by, I think the elephants and the giraffes, and they lost several giraffes and several other animals. There have been a few fires in America, so just as a fire risk and

bearing in mind there are lots of accumulations of dry material, dry bedding, or whatever.

9) There's some research that's been done in relation to the positioning of particular species, because there are some species you don't want people to disturb, so you don't want them on the main routes. There is some evidence that people are reluctant to stray away from the main routes, especially if the only way of getting back onto the main route is to come back the way they have already been. So in some respects it's quite useful to put some species away from the main routes where relatively few people will see them, because you don't want them to be disturbed. So you wouldn't put a very sensitive species, or you shouldn't put a very sensitive species, right near the entrance, because there's a good chance everybody's going to go and see it as soon as they come in. Because most people look at the things near the entrance and they'll then go and see it on the way out as well, so that particular exhibit might get twice the attention that other exhibits might get.

10) The main concern I would have [about reading ages on signs], I think, would be about the language. Because when people learn about this they usually say 'green plants, herbivores, carnivore, top carnivore', but 'top carnivore' gets interchanged with 'super carnivore, super predator, top predator'. There are probably about four or five different terms people use, for basically carnivores that eat other carnivores.

Appendix 9: Interviewee Quotations: Professor Geoff Hosey

This appendix provides verbatim quotations from the interview with Professor Geoff Hosey. Quotations are listed which are relevant in relation to the research aim, including all those referenced within the main thesis text.

1) Quite often you get seating that looks directly into the sun, or something like that, or it's not shaded. You can see just from the pattern of where people sit, the sort of things they prefer. They prefer something that's in the shade, back to the sun, something like that. They actually probably like to sit where they've got a good view of something, but there's a tension then between having them chronically in a place where there're affecting the animals and having them where they give you a good sight of something. But all zoos have got places where good seating could be put. I think it's not clear in too much detail what the consequence for the animal is of having people stay at the enclosure for a long time. Somebody sitting right outside a primate group having their lunch is probably quite stressful for the animals so seating that is going to be used for people eating their sandwiches or something like that should really ideally be moved away from the animal areas.

2) I think some of the enclosure signage, where you are telling some people something about the animal; then yes, the photographs make it real. So you can show photographs of this animal with its cubs last year, or this animal doing something with an enrichment that's been put in, or something like that. And what you're showing is episodes in the life of that animal.

3) I can see the point in something like that [manifold animal imagery on exhibit labels] for an aviary, where you might have forty different species of birds around you. You give little pictures to allow people to identify individual species. Likewise in an aquarium, when you have half a dozen fish species in a tank. What I think most people want to read about, or want to know about is: 'is the animal I'm looking at male or female, how many of these have you got, what are they called, have they had babies recently, have they got babies now'. I think those are the things most people want to know about. And I think quite a lot of zoos do that now for their great apes. So you go

to a lot of great ape enclosures in zoos and you will see photographs of the individual animals with their name and where they came from, how long they've been at that zoo, how old they are, and other information like, this is such-and-suches daughter, or this is such-and-suches father. And those are the sorts of information that people like. That's not educational, but it does raise awareness. And it raises empathy, so it has its place, it has its value, and it also possibly makes it more likely that people will be willing to financially support some of the initiatives surrounding those animals.

4) Well I can see why there isn't one [a species distribution map] for the camel because this is an example of one that's almost extinct in the wild, and the ones in captivity are not wild. It's not the wild subspecies, it's the domesticated subspecies. So in a sense having a map for that would be like having a map for an enclosure that had a heard of Friesian cows in; it's not relating to that animal. You wouldn't have them for them, or for the dromedary, you wouldn't have them for llamas or alpacas. I think part of the problem, when you go back to the sixties, the maps that they had on enclosures in the sixties showed a big lump of land where this animal was found. What we know now is that there're found in that forest, and in that forest, and that forest, but not in the bits in-between, and actually portraying that is going to be quite difficult. It's probably easier with something like lions, which are quite widespread. There're not common, but there're widespread in the wild so you could actually shade in quite biggish parts of East Africa and one or two more little bits of West Africa. This is where lions are found in the wild, but in all of those areas there're locally endangered. But with something like say the rusty-spotted cat you would be probably pointing out two or three individual forests, so it's not so easy these days. I think as well it gives a mixed message, because if you see a map of Africa with a big area of black in it, which says this is where lions are found, you come away thinking, oh pretty much the whole of Africa, there're pretty common, but there're not you see. These are areas where they could be found. I think it's that kind of mixed message that the map gives a false impression; it tells you where people have seen them, but it doesn't give you any information about how abundant they are within that area. You contrast a map for lion distribution, which would show quite large parts of Africa in black, but which I mean alright there are several thousand animals still in the wild, but there're locally endangered. And there're under threat because there're being persecuted. You contrast that with the ring-tailed lemur, which is very common in zoos, but endangered in the wild. And if you look at a map of that there

would be two little blocks of forest in South Madagascar. This is where they are found in the wild and you would look at those and think well that must be a very rare species, but the lion isn't, because these lemurs are only found in those two little forests, whereas the lion is found throughout Africa. But there're actually probably from a conservation point of view equivalent to each other in terms of how endangered they are.

5) I think part of the problem [with using imagery to underpin Red List data] is that a lot of the animals that are critically endangered are animals that are unfamiliar to people, or else there're small and relatively easily overlooked, which is probably one of the reasons why so many of them are endangered. I mean the highest-level category before you get to extinction is extinct in the wild. And there are several species that British zoos house that are extinct in the wild. By extinct in the wild what is meant is that there are still populations in captivity, but a large number of those are in zoos, so the prime candidate is something like the scimitar-horned oryx, which is extinct in the wild, for which there is quite a large captive population, which is self-sustaining at the moment. And there are attempts to reintroduce this animal; it's reintroduced back into parts of Tunisia, but not necessarily all that successfully. But I'm not sure that most people would recognise what that animal was, but when you bear in mind that perhaps even more deserving is something like the mountain chicken, which is a kind of frog; and it's not even one of those nice brightly coloured little poison dart frogs, it's a brown splodge of a frog. It looks a bit like the sort of thing you would find under a stone in your own garden. This is critically endangered. It's only found on the island of Montserrat. It's almost certainly been depleted through those big volcanic eruptions they've had in the last 100 years, and also by hunting; I mean the name gives it away. It's called mountain chicken because people eat it, think it tastes like chicken. Critically endangered, but if you put an icon of a frog on to show the status of critically endangered most people would think, 'it's a frog'! So it's a difficult one because most of the iconic animals or familiar animals are not critically endangered. So the things that people will recognise, the iconic animals are there to draw the crowds, that's their purpose in being there. I'm not sure an icon would be a great deal of help for most people, and I certainly can't really think of what an icon would be.

6) I think feeding by the public is one of the biggest problems in a lot of zoos. Potentially the consequences of feeding by the public are catastrophic and I think it's something where the message really needs to be got across very very powerfully.

7) I've got a photo of a big sign that says 'please do not feed your fingers to our animals', and I think something like that, it conveys a message in a way which is not offensive to people, I think, but gives the point very firmly. They are designed to give a message without it being stark; it softens the message because people go to zoos because there're looking for an enjoyable experience. And I suppose what I'm saying is that they don't want to be bombarded with: 'don't do this, don't do that, you can do that, but you can't do that'.

8) I think the whole point of them [the pictograms on Chester Zoo's wayfinding signs] is they're generic images so they're not supposed to represent a particular species but the kind of animal that you see there, so the flamingo there for example. Waterfowl in this case probably does direct you to the flamingos, but it could direct you to a pond with ducks in and things like that. So it's just a generic sign. The hoofed stock, there's no way of knowing what that is, but it's an antelope like figure and hoofed stock covers such a multitude of different things. So it could be antelopes, it could be cattle, it could be zebras, it could be giraffes; it could be all sorts of things. They would probably have a separate symbol for the giraffes because people like to see animals like that, but most people don't distinguish different kinds of antelope, so that will take them to where the hoofed animals are. In Chester, for example, a sign pointing to realm of the red ape encompasses orangutans, it encompasses South East Asian animals, it encompasses small mammals, it encompasses some reptiles, some birds, things like that. But just the one sign, realm of the red ape, points you to that whole exhibit. So that helps to declutter by having a themed area.

9) I've never really thought of colour [on zoological signs]. I think colour coding probably only works if you're aware that things are colour coded and what the colour codes mean. I've been to Belfast a couple of times and I've never really realised it's [exhibit labels are] colour coded; it's passed me by, so I'm not sure that in that sense it works all that well. It's not necessarily pointed out to casual individual visitors, or if it is, it's pointed out somewhere where you have to find it.

10) I would guess they've had a form of design consultants in to do all of their signage in one go and their own logo and their maps and things like that as well. There's a long history of zoos being plagued by people who are experts in something or another but who don't know the first thing about animals. It's rubbish [the orangutan image on Chester Zoo's map] as well because it's supposed to be an orangutan; it actually looks like a chimpanzee. Doesn't look like an orangutan at all, and again I would guess that it comes from some consultant somewhere; 'it's an ape, it's red, so realm of the red ape'!

11) They [the maps at Chester Zoo] can be difficult for the enthusiast I think who wants to go and see the black-footed cat or the Philippine cloud rat, or something like that. Where do you actually find it, because even when you look at the key to the logos the most you'll see is something like primates or small mammals, or something like that. So I think there're designed really for the majority of ordinary zoo goers who just want to find their way round all the different exhibits and know where they are.

Appendix 10: Ethical Approval Form CST 13/116

Academic Audit and Governance Committee

College of Science and Technology Research Ethics Panel (CST)

To	**Michael David William Richards (and Prof M Ormerod)**
cc:	**Prof Charles Egbu, Acting Head of School of SOBE**
From	**Nathalie Audren Howarth**, **College Research Support Officer**
Date	**14 February 2014**

Subject: **Approval of your Project by CST**

Project Title: **Inclusive Design: Zoological Street Furniture**

REP Reference: **CST 13/116**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Nathalie Audren Howarth
College Research Support Officer

Appendix 11: Non-disclosure Agreement Signed by Professor Geoff Hosey

NON-DISCLOSURE AGREEMENT

THIS AGREEMENT is made on   14/12/2013

BETWEEN

1. **Michael David William Richards,** (the "Disclosing Party"); and
2. **Geoff Hosey,** (the "Receiving Party") - collectively referred to as the "Parties".

RECITALS

A. The Receiving Party understands that the Disclosing Party has disclosed or may disclose information relating to his research on zoological street furniture, which to the extent previously, presently, or subsequently disclosed to the Receiving Party is hereinafter referred to as "Proprietary Information" of the Disclosing Party.

OPERATIVE PROVISIONS

1. In consideration of the disclosure of Proprietary Information by the Disclosing Party, the Receiving Party hereby agrees: (i) to hold the Proprietary Information in strict confidence and to take all reasonable precautions to protect such Proprietary Information (including, without limitation, all precautions the Receiving Party employs with respect to its own confidential materials), (ii) not to disclose any such Proprietary Information or any information derived therefrom to any third person, (iii) not to make any use whatsoever at any time of such Proprietary Information except to evaluate internally its relationship with the Disclosing Party, and (iv) not to copy or reverse engineer any such Proprietary Information. The Receiving Party shall procure that its employees, agents and sub-contractors to whom Proprietary Information is disclosed or who have access to Proprietary Information sign a nondisclosure or similar agreement in content substantially similar to this Agreement.

2. Without granting any right or license, the Disclosing Party agrees that the foregoing shall not apply with respect to any information following the disclosure thereof or any information that the Receiving Party can document (i) is or becomes (through no improper action or inaction by the Receiving Party or any affiliate, agent, consultant or employee) generally available to the public, or (ii) was in its possession or known by it prior to receipt from the Disclosing Party as evidenced in writing, except to the extent that such information was unlawfully appropriated, or (iii) was rightfully disclosed to it by a third party, or (iv) was independently developed without use of any Proprietary Information of the Disclosing Party. The Receiving Party may make disclosures required by law or court order provided the Receiving Party uses diligent reasonable efforts to limit disclosure and has allowed the Disclosing Party to seek a protective order.

3. Immediately upon the written request by the Disclosing Party at any time, the Receiving Party will return to the Disclosing Party all Proprietary Information and all documents or media containing any such Proprietary Information and any and all copies or extracts thereof, save that where such Proprietary Information is a form incapable of return or has been copied or transcribed into another document, it shall be destroyed or erased, as appropriate.

4. The Receiving Party understands that nothing herein (i) requires the disclosure of any Proprietary Information or (ii) requires the Disclosing Party to proceed with any transaction or relationship.

5. The Receiving Party further acknowledges and agrees that no representation or warranty, express or implied, is or will be made, and no responsibility or liability is or will be accepted by the Disclosing Party, or by any of its respective directors, officers, employees, agents or advisers, as to, or in relation to, the accuracy of completeness of any Proprietary Information made available to the Receiving Party or its advisers; it is responsible for making its own evaluation of such Proprietary Information.

6. The failure of either party to enforce its rights under this Agreement at any time for any period shall not be construed as a waiver of such rights. If any part, term or provision of this Agreement is held to be illegal or unenforceable neither the validity, nor enforceability of the remainder of this Agreement shall be affected. Neither Party shall assign or transfer all or any part of its rights under this Agreement without the consent of the other Party. This Agreement may not be amended for any other reason without the prior written agreement of both Parties. This Agreement constitutes the entire understanding between the Parties relating to the subject matter hereof unless any representation or warranty made about this Agreement was made fraudulently and, save as may be expressly referred to or referenced herein, supersedes all prior representations, writings, negotiations or understandings with respect hereto.

7. This Agreement shall be governed by the laws of the jurisdiction in which the Disclosing Party is located (or if the Disclosing Party is based in more than one country, the country in which its headquarters are located) (the "Territory") and the parties agree to submit disputes arising out of or in connection with this Agreement to the non-exclusive of the courts in the Territory.

[Disclosing Party]   **[Receiving Party]**

Name: Michael David William Richards   **Name**: Geoff Hosey

Signature: **Signature:**

Address: Nautilus, Woodlands Avenue, Chester,   **Address**: 46 Shorefield Mount, Dunscar, Bolton, BL7
Cheshire, CH1 4AT   9EW

Date: 14/12/2013   **Date**: 11/02/2014

Appendix 12: Participant Response Form for Experiment 1

Name: _____

[ ] Declined to state

Gender:
[ ] Male   [ ] Female   [ ] Other   [ ] Declined to state

Nationality: _____

[ ] Declined to state

Age Range:
[ ] 18 to 27   [ ] 28 to 37   [ ] 38 to 47   [ ] 48 to 57
[ ] 58 to 67   [ ] 68 to 77   [ ] 78 to 87   [ ] 88 and Over
[ ] Declined to state

Do you consider yourself to have any form of visual impairment?
[ ] Yes   [ ] No   [ ] Declined to state

If so, please provide details: _____

Please select the design that you **prefer** by ticking the relevant box:

Prefer – 'to like someone or something more than someone or something else, so that you would choose it if you could' (definition from the Longman Dictionary of Contemporary English).

Preference at 3 metres   **Preference at 6 metres**   **Preference at 9 metres**

[ ] Pictogram   [ ] Pictogram   [ ] Pictogram
[ ] Photograph   [ ] Photograph   [ ] Photograph
[ ] Neither   [ ] Neither   [ ] Neither
[ ] Declined to state   [ ] Declined to state   [ ] Declined to state

Additional comments:

Appendix 13: Ethical Approval Form CST 12/17

Academic Audit and Governance Committee

College of Science and Technology Research Ethics Panel (CST)

To	**Michael Richards and Prof Marcus Ormerod**
cc:	**Prof Mike Kagioglou, Head of School of SOBE**
From	**Nathalie Audren Howarth**, **College Research Support Officer**
Date	**24 July 2012**

<u>**Subject:**</u>	**Approval of your Project by CST**
<u>**Project Title:**</u>	**Pictogram vs. Photograph: An Experiment at the Welsh Mountain Zoo**
<u>**REP Reference:**</u>	**CST 12/17**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Nathalie Audren Howarth
College Research Support Officer

Appendix 14: Ethical Approval Form CST 14/32

Academic Audit and Governance Committee

College of Science and Technology Research Ethics Panel (CST)

To	**Michael Richards (and Prof Marcus Ormerod)**
cc:	**Prof Charles Egbu, Acting Head of School of SOBE**
From	**Nathalie Audren Howarth**, **College Research Support Officer**
Date	**15/07/2014**

Subject:	**Approval of your Project by CST**
Project Title:	**Zoological Logo Design: Preference for the Inclusion of Animal Imagery**
REP Reference:	**CST 14/32**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Nathalie Audren Howarth
College Research Support Officer

Appendix 15: Participant Consent Form for Experiment 1

The following information outlines your potential involvement in an experiment that has been designed to compare preferences for pictograms and photographs on zoological garden signs. The experiment is taking place at the Welsh Mountain Zoo, where two new signs have been temporarily installed. They have been designed as possible alternatives to an existing sign. The experiment is part of a PhD programme of research being undertaken by Michael David William Richards, in conjunction with the University of Salford. No external funding is currently being provided.

What will participation involve?
You will be asked for your opinion on which of two signs you prefer over three different distances. You will also be able to make additional comments on the topic.

Will involvement be confidential?
All data collected will be securely stored and password protected. Only the researcher will have access to it. The data collected will be used as part of a PhD thesis and could be published at a later date. You will not be named directly.

How long will participation take?
Participation is likely to take up to five minutes and is voluntary. The option to decline to answer particular questions (while still answering others) is provided alongside each individual question on the response forms. Those involved can stop proceedings at any time once underway, without justification or consequence. Following a request for withdrawal the option to retract all data provided will be presented.

Why have I been asked to take part?
You have been asked to take part in the experiment due to your visit to the Welsh Mountain Zoo.

What if I have further questions?
Further questions are welcomed prior to providing consent and additional copies of this form are available to take away.

Participant
I have read, understood, and accepted the preceding information:

Signature: …………………………………………………………… Date: __/__/____

Michael David William Richards

Signature: …………………………………………………………… Date: __/__/____

Email: m.d.w.richards@edu.salford.ac.uk   Telephone: 07941781336

Questions about the research should be forwarded to **Professor Marcus Ormerod**

Address: Room 423 Maxwell Building, University of Salford, Salford, M5 4WT
Email: m.ormerod@salford.ac.uk   Telephone: 0161 2955405

Appendix 16: Experiment 1 Report

Abstract

When the design of directional signage takes into account both the needs of different types of end users and the nuances of a specific environment, this can greatly enhance a localised wayfinding system. This need for contextualised wayfinding design is particularly apparent within zoological gardens, as the presence of captive animals represents a distinctive challenge in terms of sign design. Equally, zoological gardens are visited by a wide range of people, including foreign tourists, hence the increased need for signage to be universally comprehensible.

Observations from four United Kingdom zoological gardens revealed that on-site directional signs display either text alone, or pictograms and text. This finding highlighted a missed opportunity in terms of depicting species-specific detail, as photographic imagery can offer an enhanced level of detail, when compared to equivalent pictograms. For example, a pictogram of a wild horse (*Equus ferus*) and a common zebra (*Equus quagga*) look almost identical, whereas photographs of these two animals are very different. Therefore, when the imagery on a photographic sign is understood, visitors who cannot read supportive text have equal access to information as those end users who can. Importantly, from an inclusive design perspective, photographs can increase access to information. Despite the validity of this argument, it was important to gather end user preferences before suggesting that zoological gardens should install photographic directional signs. This is because a design paradigm that is theoretically superior, but is not actually preferred by end users is of questionable value in terms of its application.

During August and September 2012, visitors at the Welsh Mountain Zoo were asked which of two directional sign designs they preferred, using self-report measures. One sign displayed a pictogram and one displayed a photograph. Results were recorded at three separate viewing distances: three, six, and nine metres. The experiment hypothesis was that people would prefer the photographic sign, due to its vibrancy and clarity. Quantitative and qualitative results from 219 participants show that overall the sign that

displayed a photograph was preferred. This has indicated that in a zoological context photographs should be considered as an accessible communication medium for directional signage, despite the fact that related literature typically advocates the use of pictograms only.

Introduction

Observations from four United Kingdom zoological gardens revealed that when imagery is displayed to convey a message on directional signage it is limited to the use of pictograms. Internationally recognised pictograms are the most widely used images for accessible public signage (Fielding, 2009), achieving clarity without the barrier of traditional language comprehension (Abdullah and Hübner, 2007). Pictograms are not pictures; rather they are pictorial representations (Abdullah and Hübner, 2007). Toilet pictograms, for instance, are typically displayed in public places and their meaning is widely understood (Kjorup, 2004). Fielding (2009) argues that comprehension of pictograms is dependent upon a combination of simplicity, legibility, and recognition. Thus, successful communication of a message is dependent upon its target demographic (Ambrose and Harris, 2005).

Effective pictograms are simple to understand as they create associations of meaning, however, many do not share a visual similarity with the image they represent (Kjorup, 2004). A pictogram of a bus, for instance, is typically used to indicate a bus stop, rather than an actual bus. Similarly, a knife and fork pictogram is conventionally used to signify a restaurant, rather than cutlery (see figure A.1). In a zoological context, animal pictograms represent animals within their enclosures. While some pictograms may be used to represent the enclosure of a specific species, others may be used to represent numerous enclosures for a specific genus or for multi-occupancy enclosures, which house more than one species.

Figure A.1: Restaurant pictogram
Royalty free image

A consideration of contextualised pictogram use for directional signs relates to the broader topic of wayfinding. Literature states that wayfinding design facilitates orientation and navigation (Fielding, 2009). It reduces environmental complexity, allowing people to make route decisions and to undertake a process of continual route monitoring, prior to arrival at a desired destination (Fielding, 2009). Beyond signage, a wide array of environmental data can contribute to a wayfinding paradigm; landmarks for example can be used to determine location or to make directional choices (Afrooz *et al*, 2014). In a typical zoological garden, many varying cues exist, such as litter bins and statues. The most obvious, in terms of its explicit function, is directional signage. Thus, the experiment focuses upon this type of perceptual cue as a suitable starting point for this novel research area.

The rationale for this experiment is based upon the argument that photographs can offer an enhanced level of species-specific detail when compared to pictograms, with reference to directional zoological signage. This is particularly relevant when species share a similar symbolic outline with others within their genus. For instance, a pictogram of a cheetah (*Acinonyx jubatus*) and a cougar (*Puma concolor*) look very similar, however photographs of these two animals look quite different. It is therefore clear that for people who cannot read supporting text, photographs can offer enhanced access to information. This argument functions with greater rigour in terms of iconic species, such as the aforementioned cheetah. Conversely, a photograph of a lesser-known species, such as an Indian muntjac (*Muntiacus muntjak*), is unlikely to offer an enhanced level of species-specific detail for a typical zoological garden visitor who is liable to consider both a pictogram and a photograph of this species as an image of a type of deer, and nothing more. Nevertheless, a photograph of an Indian muntjac could be more useful for a zoologist when compared to a pictogram of the same species. Consequently, and from an inclusive design perspective, photographs theoretically increase access to information for experts without negatively influencing information provision for other users. They are potentially useful concerning both iconic and obscure species, albeit they are likely to be useful for a greater percentage of the population when considering iconic species only.

Figures A.2 and A.3 illustrate the potential advantages photographic imagery presents. When viewing figure A.2, most illiterate people would only know that the image represents a species of bear. Figure A.3 would provide this group of end users with the knowledge that a brown bear (*Ursus arctosis*) is being represented, so both an illiterate person and an individual who can read the text on display would be privy to the same information, albeit in different formats. The point being made here is also relevant for tourists who visit zoological gardens from outside of the United Kingdom and may not be able to read English text, or for people who have lost their ability to read after a stroke or brain injury.

Figure A.2: Brown bear (Ursus arctosis) signage (pictogram)
Design by the author using a royalty free pictogram

Figure A.3: Brown bear (Ursus arctosis) signage (photograph)
Design by the author using photography by Mike Levin

The importance of providing imagery that increases access to information for people who cannot read supportive text links to inclusive design philosophy. Inclusive design is

defined as *'a way of designing products and environments so they are usable and appealing to everyone regardless of age, ability or circumstance by working with users to remove barriers in the social, technical, political and economic processes underpinning building and design' (Ormerod et al, 2002: 1).* Hence, it encourages designing for low capability levels (Clarkson, 2009). To achieve this goal, it is typically associated with an in-depth understanding of diverse needs and aspirations, informed by ongoing engagement with end users throughout a design process (Ormerod *et al*, 2015). Rather than employing a solely functional perspective, the user experience, in terms of pleasure, preference, and convenience, is a central consideration (Coleman, 2011). Accordingly, this experiment has documented visitor preferences to support the argument that photographic imagery should be displayed on zoological directional signage.

Directional signage in zoological gardens is an under researched area; however, some existing literature and research is of relevance. Rees (2011) argues that zoological imagery conveys directional information more effectively compared to text alone, especially for children and foreign visitors. This argument suggests that as imagery is useful, further study to determine what type of imagery is preferred is also useful. Shettel-Neuber and O'Reilly (1981) found that zoological garden visitors prefer following a suggested route, rather than one of their own choosing. This again suggests that research pertaining to zoological wayfinding is valuable. Research undertaken by Sakai *et al* (2010) has revealed that zoological garden visitors like the inclusion of animal pictograms on directional signage. Visitors were comparing pictogram signs to text only alternatives, so this finding supports the case for image inclusion, while posing unanswered questions regarding other image types, such as photographs.

No current literature specifically promotes the use of photographs on zoological directional signage, nor does it discuss why photographs have not previously been employed in this role to increase access to information. Tinkler (2013) does however note that photographs can offer high levels of detail when compared to other visual mediums, without making specific reference to signage. Binder and Schöll (2010) have documented how farmers prefer photographs rather than pictograms as they relate to their concept of reality. Further related research is limited to contextualised pictogram comprehension, rather than preferences comparing both pictograms and photographs.

Rother (2008) has recorded confused interpretations of pesticide pictograms in South Africa, while Dowse and Ehlers (2004) have documented highly inconsistent levels of medical pictogram interpretation, also in South Africa. Interpretation issues, such as these, suggest that alternative communication mediums should be evaluated and considered for use.

To explore the issues mentioned within this introduction, an experiment was undertaken on-site at the Welsh Mountain Zoo. Visitors were shown two sign designs at three separate viewing distances; one sign displayed a pictogram and one displayed a photograph. They were then asked which of the two signs they preferred. The experiment hypothesis was that zoological garden visitors would prefer a directional sign that displayed a photograph rather than one that displayed a pictogram, as it would require less interpretation, offer an increased level of reality, and be more engaging. The hypothesis was based upon literature references to photographic detail (Tinkler, 2013) and reality (Binder and Schöll, 2010), and the aforementioned theory regarding an increase in species-specific detail. Results show that most visitors preferred the sign that displayed the photograph. This suggests that directional photographic signs should be considered for use in zoological gardens, due to visitor preference and an increase in species-specific detail.

Method: Design

The experiment took place at the Welsh Mountain Zoo, where two new signs were temporarily installed. Ethical approval was granted by both the University of Salford and the Welsh Mountain Zoo. Figure A.4 shows the design that incorporated a pictogram, while figure A.5 shows the design that incorporated a photograph. Both signs were designed as possible alternatives to an existing sign that was highlighted as being poorly conceived, from an access to information perspective. The main issues associated with the original sign (as shown in figure A.6) were that it relied solely upon text and did not display the international symbol for accessibility, which is typically used to denote an accessible route (Noble and Lord, 2004).
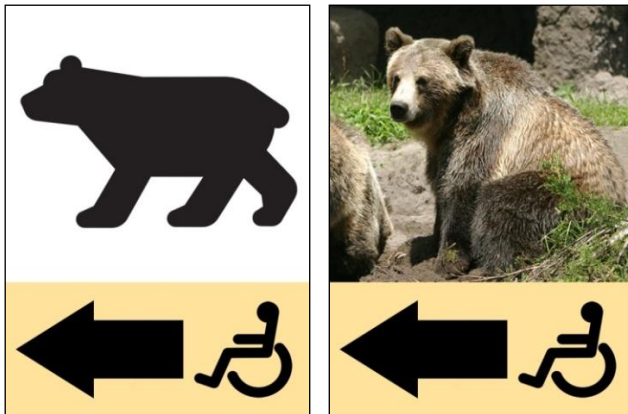

Figure A.4: Brown bear (Ursus arctosis) directional signage (pictogram)

Figure A.5: Brown bear (Ursus arctosis) directional signage (photograph)

Designs by the author using royalty free pictograms and photography by Mike Levin

Figure A.6: Brown bear (Ursus arctosis) directional signage (text only)

The first independent variable in the experiment was the communication medium (pictogram or photograph), as this was under the researcher's control. The second was the distance at which the signs were assessed (three, six, and nine metres), a factor also under the researcher's control. The dependent variable was individual participant preference for one of the signs, at each distance.

The experiment represents a single case, focusing upon one species. Clearly, given the context, many others could have been selected. The brown bear (*Ursus arctos*) was chosen because a generic bear outline clearly illustrates the argument that photographs offer enhanced species-specific detail, when compared to pictograms. This argument is especially convincing when the brown bear is compared to the polar bear (*Ursus maritimus*), black bear (*Ursus americanus*), or giant panda (*Ailuropoda melanoleuca*), due to clear physical differences, which are difficult to convey using pictograms. In terms of practicalities, the fact that the Welsh Mountain Zoo houses brown bears allowed the experiment to relate directly to a real enclosure. The popularity of brown bears with visitors was also of relevance. Some visitors may not have known what a spectacled bear (*Tremarctos ornatus*) was, irrespective of image choice.

Detailed guidance on reading distances for text based signs, which evaluates the relationship between text sizes and reading distances, is widely available. For example, literature recommends *'a ratio of cap height to (minimum) reading distance of 1:250, so cap type that is 1cm high can be read 2.5 metres away' (Baines and Haslam, 2005: 199)*. Literature does not however provide similar guidance for signage without text. It was not possible to adapt the rules for text-based signs to suit the needs of the experiment. A new calculation would be required to determine accepted reading distances and in turn analyse how distance influences the legibility of both pictograms and photographs. To begin to explore this topic in terms of preference, commonsensical distances were selected for the purposes of the experiment.

Method: Participants

Representative sampling was utilised, as all people taking part in the experiment were visitors at the Welsh Mountain Zoo. Therefore, their views were used to represent other

zoological garden visitors. Those taking part had to be over 18 years of age. People who looked under 21 were not asked to take part, in an attempt to ensure that this rule was adhered to during the experiment. This stipulation eased the process concerning ethical approval for both the University of Salford and the Welsh Mountain Zoo. Despite the age restriction and specific location, random sampling was employed on-site. All people who took part in the experiment did so voluntarily and did not receive any form of remuneration for taking part. A total of 263 people were asked to take part in the experiment, with 44 declining to do so, leaving 219 results. It is recognised that the experiment presented a barrier for anybody who could not communicate, or could not understand a request to take part. It was also an exclusively visual experiment, meaning that some people with a vision impairment were not able to participate.

According to data provided by the Welsh Mountain Zoo, the organisation received approximately 126,000 visitors during 2010 (Jackson, 2011). This figure provided an approximate daily population of 345. Through the use of this statistic as a population figure, it was possible to determine an appropriate sample size of 219 using an online tool provided by Creative Research Systems (2012). A chosen confidence level of 95% and a confidence interval of four were utilised to run the calculation.

Method: Apparatus and Materials

The primary apparatus required were the two signs on signposts, which were cable tied to fencing, while chalk and a tape measure were used to make floor markings relating to the three viewing distances. Visitors were provided with a pen and a clipboard to assist them in completing the response forms, which were stored in a folder following completion. Experiment materials included 219 participant consent forms and 219 experiment response forms.

Method: Procedure

Visitor responses were gathered over four days during August and September 2012. The dates in question were the 26th of August, the 28th of August, the 2nd of September, and the 4th of September. Responses were taken from approximately 9.30am to 5.00pm each

day. All responses were taken on-site at the Welsh Mountain Zoo. 58 responses were recorded on the first and second day. The third date provided 53 responses, and 50 responses were recorded on the final day to reach the desired target of 219.

Potential participants were approached by the author and asked to participate when passing by the signs. People were not asked to participate again if they walked past the signs more than once, to avoid multiple sets of results from one person. All individuals taking part were asked if they preferred the temporary sign that displayed a pictogram or the temporary sign that displayed a photograph. Participants were first asked to state their preference at three metres, then six metres, and finally at nine metres. They were also able to make additional comments on the topic. This allowed for the collection of qualitative feedback from prospective end users.

Quantitative Results

Table A.1 shows all of the quantitative results. Table A.2 shows Chi-Square tests for the three separate distances and for the total responses for the pictogram and the photograph. In all cases, the p-value is less than 0.05. This means that the total responses and the differences in preference at each of the three viewing distances are all statistically significant. For statistical testing purposes, those that responded neither and declined to state have been removed, and this then necessitated the removal of one of the responses for photograph at three metres.

	9 Metres	6 Metres	3 Metres	Total Participant Preferences
Pictogram	134	92	57	283
Photograph	81	123	159	363
Neither	2	2	2	6
Declined to State	2	2	1	5
Total Number of Participants	219	219	219	657

Table A.1: Experiment 1 quantitative results

		3 Metres	6 Metres	9 Metres	Total Participant Responses
Observed	**Pictogram**	57	92	134	283
Observed	**Photograph**	158	123	81	362
Expected	**Pictogram**	107.5	107.5	107.5	322.5
Expected	**Photograph**	107.5	107.5	107.5	322.5
	P =	5.65254E-12	0.034499692	0.000300847	0.001866938

Table A.2: Experiment 1 Chi-Square tests

Qualitative Results

This section presents what were deemed to be relevant qualitative results, following a process of directed content analysis. The process was directed as it linked to inclusive design, and more specifically, signage preference. Thus, additional comments, which were revealing in terms of this topic, are included, while a small number of unrelated, unrevealing, and idiosyncratic comments have been omitted. Not all people who took part provided optional additional comments. In total 17 people chose not to do so. The qualitative results are as follows:

- 54 additional comments referenced the clarity of the photographic sign. For example, *'it's clear what you are going to see'*.
- 54 people stated that the pictogram sign was clearer when the viewing distance was increased. For example, *'at a distance the pictogram stands out more'*.
- 49 people praised the general clarity of the pictogram sign. For example, *'it stands out a lot more'*.
- 32 comments referenced the appealing nature of the photographic sign. For example, *'it's attractive and nicer looking'*.
- 24 people claimed that when viewing distance was increased the photographic sign began to blend into the background. For example, *'the photo blends in with the scenery at a further distance'*.
- 20 people criticised the clarity of the pictogram sign. For example, *'the pictogram could be some other animal'*.
- 15 participants criticised the photographic sign, claiming that it was more difficult to make out from a distance. For example, *'the photo is not as clear at a distance'*.
- 15 people stated that the photographic sign was positive for children. For example, *'kids wouldn't understand a pictogram'*.
- Eight people referred to problems that the sun caused when viewing the photographic sign. For example, *'the photo is difficult to make out in the sun'*.
- Eight people stated that the pictogram was clearer for people with a visual impairment. For example, *'people with visual impairments would find the pictogram easier to understand'*.
- Six people said that the photograph was preferred, but only *'close up'*.
- One participant stated explicitly that had the photograph been displayed against a white background, it would have been selected at all three viewing distances.

Discussion

Although the pictogram sign was favoured at nine metres, the quantitative results show that the photographic sign was preferred at three metres, six metres, and overall; hence, the original hypothesis has been confirmed. Discounting the responses for neither and

declined to state, approximately 57% of participants preferred the photographic sign, while around 43% preferred the pictogram sign overall. These results challenge the work of authors such as Abdullah and Hübner (2007) who champion pictograms as a universal communication medium, whilst also questioning research undertaken by Sakai *et al* (2010), who found that people like animal pictograms on zoological directional signs. The quantitative results also show that viewing distance significantly influenced preference. As distance increased, the likelihood of the pictogram sign being preferred also increased.

Qualitative results show that 54 people praised the clarity of the photographic sign, while 49 people made comparable comments about the pictogram sign. 32 comments referenced the appealing nature of the photographic sign. However, no participants offered similar feedback regarding the pictogram sign. Practical concerns over clarity aside, results suggest that the photographic sign had a general appeal, unmatched by the pictogram sign. This point further strengthens the argument for the use of photographic imagery on zoological directional signage, due to visitor preference.

24 people stated that the background the photographic image was set against visually blended into the surrounding foliage, causing legibility concerns. Had this not been an issue, preference selection for these 24 participants might have been completely different, increasing the popularity of the photographic sign, and in turn, strengthening the argument for photographic directional signs in zoological gardens. In fact, one participant stated explicitly that had the photographic sign been displayed against a white background, it would have been selected at all three viewing distances.

Eight visitors complained that sunlight made the photographic sign difficult to distinguish. Observations at the time clarified that this was due to sunlight passing through the temporary signs and that the sunlight had less of an effect on the pictogram sign. Following such complaints, it was explained to participants that the signs were produced inexpensively to reduce costs and would never be used as permanent on-site installations. This finding suggests that had the signs been originally produced in a thicker material then the photographic sign may have been chosen more often as a preference selection.

Although additional comments from participants highlighted a number of practical issues regarding the photographic sign, both concerns about the background the photograph was set against and sunlight are possible to address. Conversely, feedback indicated that there is an inherent problem with the pictogram sign. 20 people stated that the pictogram could be confused for another animal. Comments included *'it could be a pig'*, *'it could be anything'*, and *'it could be a polar bear or black bear'*. For these individuals, it was not unequivocally clear which species the pictogram had been designed to represent. The importance of this finding is clear, as the central role of directional signs in zoological gardens is to specify which species or genus people are trying to find. Future research could explore this topic in greater detail, by testing comprehension of various animal pictograms and photographs.

The influence distance had upon preference selection was highlighted by the qualitative results. 54 people claimed that the pictogram sign was clearer when the viewing distance was increased. Equally, 15 participants stated that as the viewing distance increased the clarity of the photographic sign decreased. In addition, six people specified that their preference for the photographic sign only existed at a reduced viewing distance. Although the photographic sign was preferred overall, the influence of distance should not be ignored. Had the experiment only been conducted at nine metres, the results would show that the pictogram sign had been preferred. Thus, if the results of this experiment are considered to be generalisable, then zoological gardens should consider the influence of typical viewing distances when selecting imagery for directional signage.

Even though the photographic sign was preferred overall, eight people claimed the pictogram sign was better for people with a vision impairment. Existing research on pictogram comprehension for people with a vision impairment has shown that pictograms are useful, but only if they are designed to draw attention to key information and remove fine detail (Katz *et al*, 2006). With reference to another typically marginalised group, 15 adults commented that children would find the photographic sign easier to understand. This notion is important from an inclusive design perspective, as it adds further rigour to the argument that photographs increase access to information for end users, irrespective of their age or ability. However, these comments were not made by children. As no children took part in this experiment, further research

involving children would be required to explore their image preferences for zoological directional signage.

Each person who took part in the experiment was asked to provide an answer at three, six, and nine metres. If a similar experiment were to be conducted in the future, it would be prudent to ask each participant for his or her preference at just one of the three distances. The reason for this is that participants may have been influenced to repeat the answer they provided at three metres at the other distances in an attempt to appear consistent, or they may have felt the need to change their answer at nine metres to provide what they thought might be the correct answer. This is a potential conditioning issue and may not actually exist; however, it may account for the number of people who did have a preference for the pictogram sign at nine metres only. Running a similar experiment with a singular response approach could confirm if this issue had influenced the results.

Both of the temporary signs were installed in identical positions on each day the experiment took place. If a similar experiment were to take place in the future, it would be worthwhile counterbalancing the order to ensure that viewing the photographic sign and then the pictogram sign, when scanning the information from left to right, did not influence participant responses. The solution would be to switch the order for half of the people taking part. In doing so, the presentation order would actually function as an additional independent variable.

In relation to statistical testing, interval ratings could be used on the participant response forms if a similar experiment were to be undertaken in the future. For example, a Visual Analog scale or a Likert scale. Doing so would produce interval or ratio data, so that data could be analysed more comprehensively using a parametric test. This would also reveal how much each participant preferred a particular sign, rather than that it simply was preferred. Utilising this approach would present the opportunity to show participants either a pictogram sign or a photographic sign in isolation, rather than by way of a side-by-side comparison, in turn eliminating concerns about presentation order influencing results.

Conclusion

Results show that visitors preferred the photographic sign overall, confirming the experiment hypothesis. Significantly, the results also show that at nine metres the pictogram sign was preferred. The experiment was successful in exploring preferences for imagery use on zoological directional signage at varying distances, yet it was restricted to an analysis of signage for only a single species.

When placed in a broader context the results have real world implications. Depending on intended viewing distances and if generality is implied, zoological gardens should now consider using photographic imagery and text on directional signs, rather than pictograms and text or text alone. Not only is photographic imagery theoretically superior in terms of conveying species-specific detail, but in this instance, it was also preferred by site visitors.

Qualitative feedback relating to the background the photograph was displayed against and the thickness of the signage material suggests that had the photographic sign design been modified it would have been more legible and therefore chosen as a preference selection more often. These additional comments, coupled with the quantitative results, have been used to develop a design solution to conclude the report. Figure A.7 shows a new design that takes into account the overall preference for the photographic sign, while also addressing comments regarding the use of a white background, which is designed to contrast its surrounding environment and the photograph itself.

Figure A.7: Brown bear (Ursus arctosis) directional signage (by the author)
Design by the author using royalty free pictograms and photography

Appendix 17: Experiment 2 Report

Abstract

When imagery is incorporated as part of logo design, this can increase access to information and widespread comprehension for people who cannot read text. However, observations from four United Kingdom zoological gardens revealed that two sites displayed text only logos. From an inclusive design perspective, this represents a missed opportunity to convey a universally comprehensible message through logo design, especially for children and foreign tourists.

For this experiment, self-report data was gathered via on-site questioning of visitors at the Welsh Mountain Zoo and via an online survey, to measure preferences people had for three different zoological logos. The logo designs used were a text only design, a design that hinted at a zoological connection through subtle imagery, and a design displaying a clear animal image. Results show that there was a strong preference amongst participants for the logo that displayed a clear animal image. This suggests that people prefer image based logos, specifically in zoological gardens. Therefore, with regards to visitor preferences and language and literacy barriers, zoological gardens should consider imagery to be a key component of logo design.

Introduction

Logos are defined as *'a graphic element to identify a company' (Adîr et al, 2014: 140).* The use of a company logo on signage offers visual confirmation that messages come from the same source and that they are interrelated (Huelat, 2007). It is proposed in relevant literature that logo designs, akin to many other visual outputs, should utilise imagery to convey a message, which is both vibrant and internationally comprehensible (Airey, 2010). Accessible signage is naturally associated with the use of imagery as a means to overcome language and literacy barriers (Fielding, 2009). Imagery use is inherently inclusive, conveying a universal message via a single communication medium (Wyman and Berger, 2005). Signs displaying imagery are both simple and welcoming (Gibson, 2009). In addition, they aid quick comprehension of information in

public areas (Abdullah and Hübner, 2007). The increase in multicultural urban locations further supports the rationale for imagery use on signage (Wyman and Berger, 2005). Despite the case for logo design to include imagery, observations from four United Kingdom zoological gardens revealed that two logo designs displayed animal imagery, while two displayed only text, representing a missed opportunity from an access to information perspective. This experiment was conducted, with preferences for different types of logo design being documented, to support the argument that zoological gardens should display animal imagery as part of their logo designs, to counter language and literacy barriers.

The importance of providing imagery that increases access to information for people who cannot read supportive text links to inclusive design philosophy. Inclusive design is defined as *'a way of designing products and environments so they are usable and appealing to everyone regardless of age, ability or circumstance by working with users to remove barriers in the social, technical, political and economic processes underpinning building and design' (Ormerod et al, 2002: 1)*. Hence, it encourages designing for low capability levels (Clarkson, 2009). To achieve this goal, it is typically associated with an in-depth understanding of diverse needs and aspirations, informed by ongoing engagement with end users throughout a design process (Ormerod *et al*, 2015). Rather than employing a solely functional perspective, the user experience, in terms of pleasure, preference, and convenience, is a central consideration (Coleman, 2011).

It was important to conduct this experiment due to the popularity of zoological gardens. In Europe, zoological gardens are the most popular paid visitor attraction (Sheridan, 2013), being visited by more than 140 million people on an annual basis (European Association of Zoos and Aquaria, 2015). In Britain, annual attendance is approximately 25 million (British and Irish Association of Zoos and Aquariums, 2015b). Visitation is socially inclusive and democratic, as zoological gardens appeal to a broad audience, which transcends economic barriers (Regan, 2005). Moreover, they are a popular attraction for foreign tourists (Baratay and Hardouin-Fugier, 2003). Therefore, their logos should be internationally comprehensible. Sheridan (2013) requests that zoological gardens respond to the needs of foreign visitors through accessible signage, and develop by carrying out extensive visitor surveys. This experiment offers a clear link to both of these requests.

At the time of writing, no research exists which documents preferences for different types of zoological garden logo. However, some related research has been conducted. Pittard, Ewing, and Jevons (2007) found that there is a universal preference for logo designs to display natural forms across Australia, Singapore, and South Africa, suggesting that cultural differences have little impact upon logo design preference. Similarly, Henderson, Cote, Leong, and Schmitt (2003) found that logo preferences are comparable across China, Singapore, and the United States of America. Despite these contributions, logo design research is generally lacking, specifically with regards to inclusive design and zoological studies.

The experiment was initially conducted at the Welsh Mountain Zoo. A second data set was gathered from an online survey of non-zoo visitors. Ethical approval was granted by the Welsh Mountain Zoo and the University of Salford. Participants were shown three logo designs and asked to state their preference. The hypothesis was that people would prefer a logo that included a clear animal image, rather than an image which offered a subtle visual connection to zoology, or to a text only logo. The hypothesis was based upon aforementioned references to vibrancy (Airey, 2010), increased comprehension (Fielding, 2009), and simplicity (Gibson, 2009). Results revealed a marked preference for the logo design that included a clear animal image, suggesting that zoological gardens can respond to visitor preferences and increase comprehension by including animal imagery as part of their logo designs.

Method: Design

The experiment gathered self-report data. Each participant was asked which of three different logos they preferred; three levels of the independent variable were used, as the logo design was the variable that was manipulated. The dependent variable in the experiment was individual participant preference for each design.

The first logo (figure A.8) was solely text based. The second (figure A.9) visually hinted at a zoological connection using patterning from a giraffe's coat, while the third (figure A.10) clearly displayed an animal image (a giraffe) to indicate the organisation's nature. A Latin square design was employed to counter any systematic ordering effects and the logos were juxtaposed for participants, to allow for a direct comparison. The text in all three designs was identical and the logos were designed for a fictional zoological garden.

Figure A.8: Salford Zoo logo (text only)
Design by the author

Figure A.9: Salford Zoo logo (visual hint)
Design by the author using royalty free imagery

Figure A.10: Salford Zoo logo (animal image)
Design by the author using royalty free imagery

Two out of the three logo designs used for this experiment incorporate giraffe imagery. Neither clarifies what type of giraffe, for instance, a reticulated giraffe (*Giraffa*

camelopardalis reticulata) or a Rothschild's giraffe (*Giraffa camelopardalis rothschildi*). Many different animals could have been selected, however a giraffe was chosen because it is an iconic species, commonly kept in zoological gardens. A European badger (*Meles meles*), for example, would not be as effective as part of a zoological logo as this creature is not typically kept in captivity. Giraffes also have unique patterning on their coats and this was useful in terms of designing the zoological hint logo.

The logo designs used for this experiment do not include images of a zoological garden; rather they are representative of the notion of zoology. The silhouette of a giraffe, for instance, is not to be literally interpreted as a giraffe; in many ways, species type is unimportant, as long as an iconic species well known for living in captivity is displayed. Giraffe imagery embodies zoological animals as a group, which in turn represent zoological gardens or a specific organisation. When viewed in the United Kingdom, an image of an iconic African animal is synonymous with zoological gardens, so the substitution of a visual of an entire site with just a single species functions with clarity and simplicity. A part is used to represent a whole; therefore, the giraffe imagery is a visual synecdoche.

Method: Participants

For the first data set, participants were randomly selected visitors at the Welsh Mountain Zoo. The only selection criterion was that visitors under the age of eighteen were not asked to take part, due to ethical restrictions. Including children in the experiment would have required a far more detailed ethical review by both the University of Salford and the Welsh Mountain Zoo. Not including children involved a degree of estimation in terms of guessing if people appeared to be over eighteen years of age. Due to erring on the side of caution this may have meant that some people who looked under eighteen but were in fact old enough to take part were not asked to participate, when they could have done so.

The second data set was compiled using an online survey. Links to the survey were sent to the author's personal contacts via email and social media. Again, those under eighteen

were not asked to take part. Unlike the first data set which represents a wide spread of ages, the second data set contains an abnormally high percentage of younger respondents, due to their availability. Eighty-eight percent of participants for the second data set were under 39. Concerning age, it is acknowledged that the high number of younger participants for the online survey may have influenced results. No participant for either data set received any form of remuneration for taking part and all participants took part voluntarily.

The sample size chosen for the experiment could not have been based on the global zoo-going population, as this would have been impractical. Accordingly, a sample size of 100 was selected for the first data set based upon expected values over the three logos. The sample of 100 people meant that the expected value was approximately 33, which is much higher than five; had all the logos been effectively the same, 33 people would have chosen each one based upon expected values. Expected values of five or less are problematic for testing purposes (Boslaugh, 2012), so a total sample of 15 people or less could have suggested that responses had been arbitrary. The second data set gathered 50 responses. The rationale for this number was identical to the first data set, however less participants were involved as this data serves primarily to support the on-site results.

Method: Apparatus and Materials

100 participant consent forms and 100 participant response forms were used to compile the first data set. Pens and clipboards were also used, as was a bag for storing completed forms. Gathering responses for the online data set required no tangible apparatus or materials. The website Survey Planet was used to present the content of the participant consent forms and participant response forms in a digital format.

Method: Procedure

Data collection took place at the Welsh Mountain Zoo on the 21st of April 2014 and the 26th of April 2014. On both of the data collection dates responses were gathered from approximately 10am until approximately 4pm. 54 responses were acquired on the first

date and 46 on the second date. Responses were gathered for the online survey from the 26th of March 2014 to the 23rd of May 2014.

Participants were asked to select a logo based only upon which one they preferred out of the three designs. To ensure reliability the concept of preferring something was explained to those taking part on the participant response forms, using a dictionary definition. Involvement was limited to marking which logo was preferred, providing optional additional comments about the logos, and providing information on age and gender. For the on-site version of the experiment, site visitors were approached and asked to take part if they passed by the lar gibbon (*Hylobates lar*) enclosure. This location was selected as it was observed to receive a high level of footfall. Online participants were sent a web-link to take part in the experiment.

The ensuing results sections only reference data provided by people who agreed to take part in the experiment. In terms of response rates, 21 people declined to take part in the on-site experiment, before the desired total of 100 responses were gathered. For the online version, 68 people had to be contacted to collect 50 responses.

Quantitative Results

Table A.3 shows the quantitative results for both data sets and the overall results. It is clear that there was a preference for the image based logo for both data sets and overall. The second data set also suggests that there is no significant difference in preference between zoological garden visitors and non zoological garden visitors. To offer statistical backing for the overall results, a Chi-Square test was performed revealing a p-value of 1.02829E-34; importantly this is far less than 0.5 (due to the presence of E) and therefore statistically the results are significant.

			Text Only Logo	Visual Hint Logo	Image Logo	Total
Observed	**Data Set 1**	**Number of participants**	2	23	75	100
	Data Set 2	**Number of participants**	1	3	46	50
		Totals	3	26	121	150
Expected			50	50	50	
		P=	1.03E-34			

Table A.3: Experiment 2 quantitative results

Confidence interval data is also included in this section and was calculated using an online tool provided by McCallum Layton (2014). Based on the overall sample size of 150, just over 80 percent of participants preferred the image based logo. Using a confidence level of 95%, there is a confidence interval of +6.32. What this means is that if the results are considered to apply to the wider population, 74.35% to 86.99% of the population will prefer the image based logo.

Qualitative Results

Additional comments from participants are presented in this section. They are displayed separately for the two data sets. Comments detailing a preference for a particular logo are grouped. Supporting narrative is provided when there is a need to contextualise comments made by participants. Minor spelling and grammar corrections have been made to a small number of the additional comments for both data sets.

On-site participants at the Welsh Mountain Zoo were found to be far less likely to provide any form of response in the additional comments section, compared to those who completed the online survey. Only 17 people offered additional commentary when partaking at the Welsh Mountain Zoo, compared to 23 people who completed the survey online. This equates to 17% of on-site participants and 46% of online participants offering additional comments.

Data Set 1: Welsh Mountain Zoo Visitors

Additional comments from people who selected the image based logo:

1. *Giraffe did it for me.*
2. *Nice pic', more appealing to children.*
3. *I think the picture spices things up. It intrigues me. Also more eye catching.*
4. *Good logo designs.*
5. *I have chosen this logo because it has got an animal on it.*
6. *Easily identifiable.*

7. *Giraffe may be better in colour.*
8. *Middle box is least favourite.* **The participant is referring to the zoological hint logo.**
9. *Second one looks dirty/scruffy.* **The participant is referring to the zoological hint logo.**
10. *Middle logo fur should be in logo one.* **The participant is referring to the image based logo and the zoological hint logo.**
11. *Mix the bottom two.* **The participant is referring to the image based logo and the zoological hint logo.**
12. *Boring.* **The participant is referring to the text only logo.**

Additional comments from people who selected the zoological hint logo:

1. *Chose this option due to its colour. Picture and colour would be better.* **The participant is referring to the image based logo and the zoological hint logo.**
2. *Liked colour, pleasing to the eye.*
3. *Stands out more – good colour.*
4. *Add the giraffe from box 1 into box 2.* **The participant is referring to the image based logo and the zoological hint logo.**

Out of the two people who selected the text only option for this data set, neither provided any additional comments.

Data Set 2: Online Survey

Additional comments from people who selected the image based logo:

1. *The picture of the giraffe grabs your attention more than the plain text.*
2. *I found this one the most eye catching and also felt it was the one which displayed its purpose best.*
3. *I like the usage of an exotic animal to further establish to the viewer that they are looking at a sign for a zoological garden.*
4. *I prefer the first (text and image) as it is timeless, simple, and appropriate. The second (text and pattern) in my opinion was better than the last (text alone) as it*

was interesting and memorable, however the pattern itself did not interest me as much as the text and image combination. The last was far too plain and uninteresting for my personal taste.

5. *I like the giraffe.*

6. *I feel that the option chosen was a modern and clean design, while the other options were either too busy in its design, or too plain.*

7. *To mix a combination of the first two makes it appealing.* **The participant is referring to the image based logo and the zoological hint logo.**

8. *Images are generally more eye catching on signage.*

9. *I like the giraffe!*

10. *I'm not necessarily sold on the giraffe, but I like the idea of the picture with the sign.*

11. *Make the giraffe bigger with it.*

12. *The logo instantly recognisable as that of a zoo.*

13. *Zoo.*

14. *Maybe add a snake to the logo, I like snakes.*

15. *I thought the one with the silhouette of the giraffe was the most recognisable of the three.*

16. *This stands out to me personally as the most striking of the three. I also liked the logo with the giraffe pattern.*

17. *Simple, yet aptly highlights what it is in a visually pleasing way.*

18. *Efficient Text+Picto = perfect.*

19. *I think it's the most striking / bold.*

20. *The final logo is a bit plain and I don't really like the print in the letters of the second logo. The first logo (preferred) is simple and memorable.*

21. *I think the logo that I chose clearly identifies that the logo is for a zoo. It stands out and isn't too fussy. The logo would be easy to identify and would work well on any additional products that Salford Zoo were to promote.*

Additional comments from people who selected the zoological hint logo:

1. *Gives the impression of looking through the letters at an animal. Watching animals is relevant to visiting a zoo.*

2. *Easy to outline both picture and writing...*

The one person who selected the text only logo for this data set did not make any additional comments.

Discussion

Combined quantitative results from both data sets confirm the experiment hypothesis by illustrating a marked preference for the logo design displaying clear animal imagery. Around 80% of the participants preferred the image based logo, while approximately 17% preferred the visual hint logo, and only 2% preferred the text only design. Consequently, the quantitative results support the argument for imagery use as part of logo design to counter language barriers, as put forward by Airey (2010). They also provide contextualised data, suggesting that zoological gardens in particular should use image based logos to take visitor preferences into account. Nevertheless, and in terms of its limitations, the experiment represents a restricted sample size and included only three specific logo designs.

In terms of the qualitative results, these served to explain why people had made their preference selections. Eight participants cited the general appeal of the giraffe imagery as the reason for choosing the image based logo, with eight people also stating that the imagery was eye catching, and five others mentioning its simplicity. These comments support the case for image inclusion, while also referencing key inclusive design topics such as increased visibility and comprehension, to underpin this intellectual position. In addition, one person claimed that the image based logo would be appealing for children. It would be particularly useful to address the relevant ethical issues and to conduct the experiment again with children, to explore this concept further.

Six participants commented that the design displaying clear animal imagery was easily identifiable as a zoological garden logo. One of these comments touched upon a key topic for further exploration: *'I like the usage of an exotic animal to further establish to the viewer that they are looking at a sign for a zoological garden'*. This comment suggests that people not only prefer animal imagery and that it increases comprehension, but that species choice is significant and that exotic animals are

perceived to be associated with zoological gardens. Future testing could be conducted with logo designs for different species, comparing preferences for exotic and indigenous species. A follow on experiment could also compare preferences between different image types for the same species. Image types could include photographs, illustrations, silhouettes, icons, and pictograms.

As detailed in the qualitative results section, three separate comments suggested that when the zoological hint logo was selected it was in part due to the use of colour. Moreover, one comment stated that the image based logo should have included colour. Displaying an element of colour on all three logos, in future versions of the experiment, would eliminate this potential validity issue. As the image based logo was preferred even without any colour, comments such as these hint that had it displayed colour, it may have been even more popular. Colour also presents a number of other opportunities for future study. Research could explore preferences for different colours as part of zoological logos, as well as the influence of age and culture in relation to colour preferences.

None of the participants who selected the text only logo provided additional comments. However, a number of other people criticised it as part of their feedback, strengthening the case for image inclusion as a part of zoological logo design. The general feeling that can be inferred from these comments is that the text only logo was considered to be too plain, and as a result, uninteresting.

Conclusion

This report has argued that zoological garden logo design should incorporate imagery to foster transnational communication. In support of this position, feedback from zoological garden visitors has shown a considerable preference for a logo design which includes animal imagery; confirming the experiment hypothesis. Participants stated that the image based logo was eye catching, simple, appealing, and most importantly, easily identifiable as a zoological garden logo. Consequently, the results of this study indicate that the notion of imagery inclusion alone is insufficient, as zoological gardens should

specifically include clear animal imagery as part of their logo designs to take visitor preferences into account and to transcend language and literacy barriers.

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