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ENVIRONMENTAL PERFORMANCE OF A CONSERVATION ATTRACTION : THE POTENTIAL IMPACT OF VISITOR LEARNING AND BEHAVIOUR CHANGE

by

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ABSTRACT

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Nature based visitor attractions desire to be a positive influence on the people who visit, whether they are day visitors, members or organised school groups. Much work has been done to evaluate learning in visitors with mixed results, and demonstrating actual change in behaviour as a result of any learning has only been possible in a few, narrowly focussed studies. Using a combination of GPS visitor tracking and surveys, never before tried on this scale in this type of attraction, variations in spatial behaviour were found with group type, with learning and with intention to change behaviour. Further public surveys, analysis of schoolchildren's drawings of animals, focus groups discussions and responses on Facebook were combined with the tracking analysis to give a unique insight into the influence of an attraction on visitor learning and behaviour change resulting from repeated contact.

Conservation organisations and attractions strive to have a positive environmental impact, but operating a visitor attraction has negative environmental and social impacts, often in direct conflict with the aims of the organisation. The negative impacts could potentially, however, be alleviated, or compensated for, if enough visitors could be inspired to modify their behaviour in their lives away from the attraction. Visitors and schoolchildren to Marwell Zoo were confirmed to be learning during their visit, and visitors were open to calls to action to prevent biodiversity loss. A small proportion reported an intention to change behaviour following their visit, and some repeat visitors gave examples of behaviours they had already changed as a result of visiting Marwell Zoo. Recommendations are made to increase the proportion of visitors changing behaviour, and a mechanism is suggested to incorporate visitor behaviour change into overall environmental reporting.

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DECLARATION OF AUTHORSHIP

I, Duncan East, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

ENVIRONMENTAL PERFORMANCE OF A CONSERVATION ATTRACTION : THE POTENTIAL IMPACT OF VISITOR LEARNING AND BEHAVIOUR CHANGE

I confirm that:

1. This work was done wholly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
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6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Part of this work has been published as:

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- Avon Beach
- New Forest Show
- Romsey Show

Definitions and Abbreviations

ArcGIS	Geographic Information System software tool
BIAZA	British and Irish Association of Zoos and Aquariums
EAZA	European Association of Zoos and Aquaria
CSR	Corporate Social Responsibility
GIS	Geographic Information Systems
GPS	Global Positioning System
GRI	Global Reporting Initiative
NEF	New Economics Foundation
R	Statistical analysis software package
RFID	Radio Frequency Identification
SPSS	Statistical analysis software
SRI	Sweep rate index
UTM	Universal Transverse Mercator
WAZA	World Association of Zoos and Aquariums

Chapter 1: Introduction and Literature review

1.1 Research Overview and Problem Statement

Educational visitor attractions such as aquaria, botanical gardens, historic sites, museums and zoos intend for visits by the public to be learning experiences as well as enjoyable days out (Falk and Dierking 2000; BIAZA 2011b; National Trust 2015; Royal Horticultural Society 2015). Many of these also have a conservation role with programmes and activities designed to have a positive impact on habitats, wildlife or heritage assets (National Trust 2015; RHS 2015; ZSL 2015; Marwell Wildlife 2017b). Operating visitor attractions, however, has a similar range of negative environmental impacts as other business types, for example, consumption of fuel, electricity and water; producing waste, emissions from staff travel, resource depletion and supply chain impacts (Raluca and Gina 2008; Hansen *et al.* 2013; National Trust 2016b). Given the desire of conservation based attractions to have a positive impact there is a notable lack of any attempt to compare positive and negative outputs and to evaluate whether an overall positive impact is being achieved. In these types of organisation positive outputs are reported in a variety of formats (for example Eden Project 2013; ZSL 2015; National Trust 2016a; RHS 2016; Marwell Wildlife 2017b) but always separately from negative impacts. Action by conservation organisations alone is not sufficient to prevent biodiversity and habitat loss, action by individuals is also needed (UNEP 2010; Moss *et al.* 2014). As a result, inspiring behaviour change in visitors is a common theme in the aims, objectives and mission statements of conservation and education based attractions (e.g. BIAZA 2011b; National Trust 2015; RHS 2015) but measuring the effectiveness of this type of activity is difficult (Falk *et al.* 2007; Smith *et al.* 2008; Packer *et al.* 2010). There is a need for a mechanism by which organisations with positive outputs can effectively measure these and compare their impact with the negative impacts of doing business.

1.2 Lessons from the business community

Measurement, management and reporting of specific environmental impacts is common among businesses with a steady growth in environmental impact assessment and mitigation through the voluntary application of international standards such as ISO14001 (Paton 2000; Neumayer and Perkins 2004). Environmental impacts are

typically measured in terms of resource use (for example agricultural crops, fuels, minerals, timber and water) and emissions (for example carbon dioxide, methane, NOx, SOx, and chemicals and sewage discharges) (Jackson 1997). These standards tend to be applied to narrow organisational boundaries, are often restricted to a single operational site and focus on performance on negative impacts (Scott Marshall and Brown 2003). A number of companies, however, have attempted to gain a more holistic picture of their organisational impacts by extending their management systems upstream to capture supplier impacts and downstream to capture customer, or use phase, and eventual disposal impacts (e.g. SustainAbility *et al.* 2008; Kingfisher 2015; GlaxoSmithKline 2017).

1.2.1 Reporting positive impact in business

Organisations in wealthier nations are increasingly adopting corporate social responsibility (CSR) as a means of ensuring that environmental and social impacts are considered in their decision making process and included in annual reports (Baughn *et al.* 2007; Carroll and Shabana 2010; BSR 2017). Good CSR reports include details on reduction in resource consumption and environmental harm and also on how they tackle social issues (Global Reporting Initiative 2006; AccountAbility 2008; CPRA 2017a). Resource consumption is typically reported quantitatively and the associated environmental impact is inferred from this data through techniques such as carbon footprinting (Dietz and Neumayer 2007; Wiedmann and Minx 2008). Social impacts tend to be reported in terms of benefits to employees, benefits to the local community and improvements to the lives of people in the supply chain. (Global Reporting Initiative 2006; Jenkins 2006). Reporting standards have been developed to aid organisations in producing reports that facilitate tracking of changes over time and of impacts between disparate organisations (Global Reporting Initiative 2006; AccountAbility 2008) but do not offer a ready means of comparing disparate types of impact.

For example, Marks and Spencer's 'Plan A' report (Marks and Spencer Group PLC 2016) won the Corporate Responsibility Reporting Award in 2017 (CPRA 2017b). The plan set out a roadmap to becoming a sustainable business which included having a positive impact in terms of being carbon positive; actively improving the lives of employees and people in the supply chain and getting customers involved in sustainability. The annual reports included a large number of metrics to record increases in positive social impacts and reductions in negative environmental impacts (Marks and Spencer Group PLC 2016) but no attempt to evaluate these against each other.

Some organisations have therefore devised mechanisms to evaluate overall impact in a range of natural and social capital areas to give an overall impression of the total impact of that organisation (Green Monday 2013; PwC 2013; Forum for the Future and The Climate Group 2014).

1.2.2 Natural capital impact

Natural Capital is defined as the stock of naturally provided assets (ecosystems) which provide a flow of benefits (ecosystem services) (Jansson *et al.* 1994; Bailey *et al.* 2006).

Techniques such as carbon footprinting, ecological footprinting, water footprinting, whole life costing and life cycle analysis attempt to provide a total measure of the impact of a product, service or organisation on the stock of natural capital (Wiedmann and Minx 2008; Finnveden *et al.* 2009; Hoekstra 2009). Each measures impacts in a different way and uses different units. For example ecological footprinting reports in bioproductive hectares whereas water footprints are measured in volumes of fresh water (Hoekstra 2009). Both techniques would therefore need to be calculated for a given organisation to gain a more complete understanding of total impact.

It is possible to use valuation techniques that use financial measures to evaluate gains and losses due to environmental impact (Pearce and Turner 1990). These can be used as a means of comparison, without having to assign actual value, by looking at changes in value over time (Natural Capital Coalition 2016). Howarth and Farber (2002) used the Value of Ecosystem Services (VES) technique to discuss how much it would cost to provide the same services if the ecosystem were damaged or did not exist. Using this principle the Dow Chemical Company partnered with The Nature Conservancy and attempted to place a value on the ecosystem services that directly benefited their company (The Nature Conservancy and DOW 2016). The ecosystem services indentified included flood protection from wetlands surrounding one manufacturing plant and emissions absorbed by forest surrounding another. Puma used a similar method to include values for the environmental losses and gains associated with their operations and concluded that nature provided £145M worth of service to support their business and supply chain (PUMA 2011).

The Brundtland commission (1987) considered both current and future value of ecosystems in their definition of sustainable development as:

> "Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" p43

Sustainable development, therefore, requires there to be no net reduction in the stock of economic, natural and social capital that is available to future generations so that they can achieve a similar standard of living as the current generation (Brundtland 1987; Pearce 1993). Weak sustainability treats all capital equally suggesting it does not matter what type of capital remains for future generations, providing the quantity is the same. Strong sustainability says not all types of capital are equal and that ecological systems (natural capital) are essential to our continued existence and should therefore be valued more highly than other types of capital (Pearce 1993; Dietz and Neumayer 2007).

Any value placed on natural systems has to consider their indirect and non-use functions, such as carbon sequestration and as habitat to a range of plants and animals, as well as any potential future use value to future generations (Pearce 1993; Stern 2006). These indirect and non-use values are likely to far exceed the value of the direct use ecosystem services but are very difficult to evaluate (Limburg *et al.* 2002; Sukhdev *et al.* 2010).

Third party impacts of environmental damage also do not show up in financial accounts because effects such as losses of individual rights do not have a monetary value (Millenium Ecosystem Assessment 2003; Stern 2006). Internalising these third party effects requires a value to be placed on these impacts, perhaps through assigning an exchange value where an individual would accept compensation for loss of an ecosystem service (Pearce 1993; Millenium Ecosystem Assessment 2003; Stern 2006). Many ecosystems, however, have value *in situ* but do not have an exchange value in the current economic model as providing the service elsewhere does not bring the same benefit to the community in the vicinity of the threat (Farber *et al.* 2002). The people of low lying island nations affected by flooding, for example, place a much higher value on protecting coastal ecosystems and avoiding climate change than people in other areas of the world seeing more distant impacts.

Furthermore some ecosystems are unique while others may be unable to recover from damage past certain tipping points and therefore need to be valued even more highly than their use, indirect services and non-use value would suggest (Cicchetti and Wilde 1992). Functioning ecosystems are essential to our continued existence and hence the need to avoid irreversible change or catastrophic failure has to be considered (Jansson

et al. 1994). As such valuation systems are prone to undervaluing natural capital (Cicchetti and Wilde 1992; Limburg *et al.* 2002).

Conservation attractions with active field programmes can contribute to the use value of ecosystems (for example by improving grazing) and non use value (for example habitat maintenance and carbon sequestration) (BIAZA 2017b).

1.2.3 Social capital and personal wellbeing

Social capital is a measure of the robustness of a society, its networks, shared norms, values and understandings that facilitate co-operation within or among groups and allow the society to function (Woolcock 1998; Healy and Cote 2001; Birch and Whittam 2008). Social accounting and auditing is developing as part of CSR and social accountability to include measures of social impact that are comparable across nations and industries (Global Reporting Initiative 2006; AccountAbility 2008). Other organisations also produce social auditing guidelines such as the New Economics Foundation (NEF) who produce the National Accounts of Wellbeing (Michaelson *et al.* 2009), a methodology for measuring subjective wellbeing at a local and national level. Each of these attempts to provide a measure of social wellbeing as distinct from quality of life. Attempts have been made to measure happiness and wellbeing (Ruut 2007; Steuer and Marks 2008) and the concept of managing local wellbeing was included in the Local Government Act in the UK (Harper and Kelly 2003). Two indicators in particular are commonly used to measure social capital: social trust and civic participation (Putman 2002; Poortinga 2006). The UK statistics office, however, chose five dimensions of social capital in order to gain a comprehensive measure: social participation; civic participation; social networks and support; reciprocity and trust; and opinion of the local area (Harper and Kelly 2003).

Income has been shown to have a weak correlation with personal happiness and wellbeing (Pouwels *et al.* 2008; Caporale *et al.* 2009; DEFRA 2011), how people spend their money is at least as important as how much they earn in determining how happy they are. Pro-social spending (defined as buying gifts for others and contributing to charity) was found to improve an individual's happiness more than spending money on themselves (Dunn *et al.* 2008). Field conservation programmes undertaken by organisations such as aquariums, botanic gardens and zoos contribute to the non-use existence value of ecosystems which are highly valued by the public (Raymond *et al.* 2009). If visitors to attractions are aware that their contribution, through the entrance

fee, is helping to support communities and improve ecosystem health, this should also contribute to their personal wellbeing.

Contact with nature has also been found to have multiple benefits to health, cognition and social interaction (Maller *et al.* 2006; Strife and Downey 2009; Keniger *et al.* 2013) and contact with animals has been linked to lower levels of stress and increased social capital (Wood *et al.* 2005). Visits to zoos and aquaria should therefore be able to boost personal wellbeing by enabling visitors to experience rare animals they would otherwise not get the chance to see.

1.2.4 Total impact measurement and the concept of Net Positive

Environmental impacts are typically physical and can be measured in standard units: tonnes of CO_2 emitted, tonnes of timber used or cubic metres of pollutant released for example. Social impacts are more nebulous, harder to measure and difficult to compare directly with other types of impact (Henriques 2015). Natural capital valuation methods attempt to condense positive and negative impacts in to a few, or a single metric for comparison (Howarth and Farber 2002; Sukhdev *et al.* 2010), but may undervalue ecosystems by missing non-use values (Cicchetti and Wilde 1992; Limburg *et al.* 2002). Total valuation techniques that attempt to combine social and natural capital impacts are highly complex and vulnerable to the combined inaccuracies of social and natural capital valuation and from faulty assumptions (O'Neill and Spash 2000). Böhringer and Jochem (2007) argue that aggregating many disparate impacts into a single unit can render the measure scientifically meaningless as any useful detail is lost in assumptions of the agregation and conversion.

A few organisations are starting to look at positive impacts and how they compare to the negative impacts that are already being measured (Kingfisher 2015; BT 2016). Guidelines are available suggesting how organisations can measure both positive and negative impact across a range of factors and determine if a whole organisation can, on balance, claim to have a positive social, environmental and economic impact (Green Monday 2013; PwC 2013; Forum for the Future and The Climate Group 2014). These organisations do not consider that there is enough information to be able to compare disparate impacts and that there is no validity to offsetting ecological damage in one part of the world with social improvements in another. The guidelines therefore recommend impacts are measured in distinct areas, such as ecological, material, carbon or social, and the balance of impacts compared within those areas (Uren *et al.*

2014). If an organisation is able to demonstrate a positive impact in each area then overall their impact could be considered to be positive.

The different mechanisms vary but typically impacts are measured in five areas:

1 Materiality and supply chain – Organisations define their key material impacts and can create positive impact by minimising material input, using the circular economy to retain materials in the supply chain and where the use of virgin material is required using only sustainably managed natural resources

2 Carbon & energy - Organisations could generate their own energy, purchase renewable energy, take part in offset schemes to reduce the emissions of others or invest in carbon capture and sequestration.

3 Customer solutions – delivering solutions that meet the customer requirement in a way that generates social and environmental benefit

4 Social and Ecological investment – investing in community programmes, environmental management and habitat restoration (e.g. reforestation) and water stewardship including marine protected areas.

5 Natural capital governance – protect the commons, use shared resources for good of local communities, wildlife and industry.

Influence on the behaviour of others, particularly customers, is a significant part of the net positive approach of some organisations. In the Kingfisher (2015) Net Positive report impacts and targets were divided into: having a positive impacts on people and communities; being restorative to the environment; carbon positive through value chain, waste nothing and create wealth. To achieve a net positive position in carbon for example, in addition to each store generating its own energy, their aim is for every customer's home to also generate more energy than it consumes. BT Group also aim to become "carbon positive" by changing the behaviour of their customers and helping them to reduce their electricity consumption by more than BT use through their own operations (BT 2016).

1.3 Behavioural change contributes to overall positive impact

Changing an individual’s behaviour depends on many factors. Ajzen’s theory of planned behaviour (TpB) (Ajzen 1991) determined three conditions that affect a

person's ability to change behaviour. These are the individual's attitude to the behaviour, the subjective norms of society and the individual's perceived level of control. In other words, an individual is more likely to adopt a new behaviour if they believe the behaviour will benefit them, if they believe others will expect them to adopt the new behaviour (conforming with society) and making the change is something they have the ability and means to achieve. These three aspects add up to form the intention to change behaviour and there is a high correlation between intention to change and actual change in behaviour (Skår *et al.* 2008; Ajzen *et al.* 2009). Cialdini *et al* (1991) make a distinction between injunctive norms, that are socially shared rules of conduct, and descriptive norms that represent the visible behaviour of others. Injunctive norms, therefore, represent peer pressure from an individual's sanctioning group (those whose values are important to them) while descriptive norms are those an individual can see taking place in the general population. For complex behaviours, such as travel options and taking part in recycling schemes, which may have a personal negative impact, TpB may be an oversimplification (Anable 2005; Nigbur *et al.* 2010). Anable (2005) suggests attitude to environmental issues, belief in the efficacy of the behaviour and habit also play a role in adopting new behaviour. Nigbur *et al* (2010) suggest self identity as a recycler, for example, is an important indicator of the likelihood of taking part in a new kerbside recycling scheme, in line with Stryker's self identity theory (Stryker and Burke 2000). Perhaps unsurprisingly several authors have found that past behaviour is a good indicator of future behaviour, e.g. someone already participating in one form of sustainable behaviour is more likely to adopt another than someone who does not (Cheung *et al.* 1999; Skår *et al.* 2008).

Hopper and Neilson (1991) found that participation in a curb side recycling programme was consistent with altruistic behaviour and that encouragement to recycle by other residents (termed 'block leaders') improved participation. Behavioural modifiers such as provision of information (leaflets) had an effect but this was lost if the modifiers were removed, i.e. the campaign by leaders ended. Hopper and Neilson proposed a third step in the TpB where the social norm is translated into a personal norm, equivalent to identifying with the behaviour, which was then translated into behaviour (Terry *et al.* 1999; Nigbur *et al.* 2010). By forming behaviour as a social or moral norm, violating that norm by behaving otherwise invokes feelings of guilt (Arvola *et al.* 2008). While the negative emotions of guilt may not be an effective way to change behaviour, feelings of pride and satisfaction of 'doing the right thing' by partaking in the behaviour are effective means of promoting behavioural change (Thøgersen 2006).

Organisations may be able to achieve an overall positive impact in certain, narrowly defined areas through their own actions, for example by generating more energy than they consume using their own solar panels or wind turbines as The Lego Group have done (Lego 2017b). Reaching a positive balance across a wider range of business activities, however, may require the action of other parties including the supply chain and customers (Kingfisher 2015; BT 2016; Lego 2017a). Organisations may, therefore, be able to achieve a net positive position through their influence on staff, through their supply chain, their customers or through other stakeholders they come into contact with. Many organisations, for example, take part in workplace activities aimed at raising awareness and changing behaviour of staff such as Fairtrade Fortnight[1], Earth Day[2], Earth Hour[3], World Environment Day[4] and Cycle to Work days[5]. All these programmes aim to change some aspect of behaviour to reduce environmental damage, reduce loss of natural capital or increase social capital.

For many educational attractions there is a desire to affect behavioural change in visitors (BIAZA 2011b; National Trust 2015; RHS 2015) who represent a much larger audience than their staff. With their access to far larger numbers of people than most businesses there is potential to make a significant contribution to alleviating local and global environmental threats, if the visitors can be sufficiently motivated (Ballantyne and Packer 2005). The cumulative reduction in environmental impact of a small change in behaviour by all visitors to an attraction could add up to significant environmental benefit. As with BT and their customers (BT 2016) this cumulative environmental impact of is likely to be larger than the impact of the attraction itself. Various authors have examined the efficacy of educational based tourist attractions in influencing the behaviour of their visitors and found varying degrees of success (Falk *et al.* 2007; Smith *et al.* 2008; Packer *et al.* 2010). Attractions should be able to apply TpB and demonstrate the ease of taking action on various issues, show how commonplace actions can be and point to the efficacy and anticipated outcome of taking action (Smith *et al.* 2010; Smith *et al.* 2012a; Esson and Moss 2014). Attractions have an opportunity to create an emotional connection with the visitor who starts to self identify as someone who wants to protect wildlife by close experiences of exotic plants and endangered animals in zoos (Kellert 1996; Moss and Esson 2010; Luebke *et al.* 2012). In this way organisations such as zoos and aquaria can prompt individuals to reconsider their role

[1] http://www.fairtrade.org.uk/en/get-involved/current-campaigns/fairtrade-fortnight
[2] http://www.earthday.org/
[3] https://www.earthhour.org/
[4] http://worldenvironmentday.global/
[5] https://www.cycletoworkday.org/what-is-cycle-to-work-day

in environmental and conservation problems, and to see themselves as part of the solution (Falk *et al.* 2007).

1.4 The potential role of behaviour change in a net positive calculation

Visitor attractions impact the environment through their supply chains, consumption of energy and water, occupation of land, transport and the movement of large numbers of visitors and the production of waste (Hansen *et al.* 2013). Conceptually these types of organisations could reduce their environmental impact to net zero using the methods suggested by groups such as Green Monday and Forum for the Future (Green Monday 2013; Forum for the Future and The Climate Group 2014). A net zero position in carbon emissions, for example, could be achieved through investment in new technology, changes in staff behaviour and operations and the purchase of good quality carbon offsets (UNFCCC 2017). With sufficient investment a conservation organisation could conceptually go further and become carbon positive through a combination of energy saving technologies, renewable energy generation and habitat restoration in their field programmes to sequester additional carbon. Alternatively, an attraction could follow the Kingfisher (2015) and BT (2016) methodology and attempt to compensate for their own emissions by reducing the emissions of the people they interact with. Field conservation programmes aim to increase biodiversity in the regions in which they occur (Marwell Wildlife 2011) which it is hoped have a larger positive impact than the negative impact on biodiversity resulting from the operation of the attraction (Marwell Wildlife 2011; Marwell Wildlife 2015). In effect Marwell are attempting to offset the residual impact on biodiversity resulting from the operation of the zoo through conservation activity elsewhere (McKenney and Kiesecker 2010). By engaging visitors in the prevention of biodiversity loss, or in active participation in conservation, additional positive impact could be achieved that has the potential to add up to a significant contribution to alleviating global biodiversity loss. In a similar vein, Marwell could attempt to offset its residual carbon footprint by inspiring visitors to reduce their own carbon emissions. Conceptually then, if the organisation can stimulate action and changes in behaviour in enough people, and in a sufficient variety of action areas, the organisation could compensate for all its negative impacts and reach an overall positive position.

1.5 Summary of Research Objectives

In order to be able to incorporate visitor behaviour change into a net positive calculation, attractions with an educational component need a method to evaluate the learning of their visitors and the degree to which behavioural modifiers are taken up and maintained by visitors following their visit. To do this they need to know what works within their attractions and what doesn't: is one area or type of presentation more successful at conveying information than another? Moreover, many attractions such as aquaria, botanic gardens and zoos, which may also operate field conservation programmes, have a desire to inspire changes in the behaviour of their visitors in order to combat habitat and biodiversity loss. The mission of these organisations is to do more good than harm, hence a mechanism is needed for them to satisfy themselves that this is the case, or to identify where they need to do more if it is not.

Using Marwell Wildlife, a conservation charity and zoo operator based in Hampshire UK, as a case study, this thesis will attempt to determine how inspiring behaviour change in visitors contributes to the overall environmental impact of an educational visitor attraction.

Marwell Wildlife already has extensive publications reporting on the success of its field conservation programmes and measures negative impact through its ISO14001 management system. The aim of this study, therefore, is to determine whether the learning opportunities, connections with nature, social bonding and ultimately behavioural change inspired by a visit to the zoo can be measured in a meaningful way that would enable an estimation of net positive impact to be made.

This will be achieved by answering the following research questions:

1 Is it possible to track visitor's spatial movements around a large attraction and determine how this movement varies with different types or groups of visitors?

2 Are visitors learning on visits to attractions and how does the visitors spatial behaviour and group type affect their learning opportunities?

3 Do visitor experiences at educational attractions inspire changes in behaviour that could contribute to reducing biodiversity loss?

4 Does learning and willingness to change behaviour increase with repeated exposure over many visits?

5 Are school children learning on formal educational visits to attractions?

6 How can an attraction account for changes in visitor behaviour and compare these against negative impacts of operation to achieve a net positive position?

1.5.1 Thesis outline

The thesis combines five different datasets gathered over 5 years utilising two large surveys, focus groups, social media data and drawing exercises for children into a comprehensive analysis of learning and behaviour change among visitors to the case study location. The scale, depth and breadth of these combined datasets is unique in UK visitor attraction impact research.

Chapter two examines research question 1 above by monitoring visitor movements within the zoological park using a method not attempted before in this type of attraction. Handheld GPS units gathered tracking data on 931 visitor groups as they explored the park and the resulting movement tracks were combined with entrance survey data. General movement patterns are discussed and variations in how different groups used the park are highlighted. The chapter concludes that GPS is an effective tracking technique for this type of attraction and that combining tracking and survey data can provide insights into differences in spatial movement and behaviour between groups.

Chapter three combines the GPS tracking data with an exit survey to address questions 2 & 3. The chapter examines visitor's recall of where they went within the park and the relationship between their spatial behaviour within the park and self reported learning and intentions to change behaviour following the visit. The chapter concludes that those most likely to report learning and an intention to change behaviour spent longer in the park and longer attending to the animal exhibits. The chapter also concludes that some groups are more likely to learn that others and discusses what an attraction can do to improve learning opportunities for all.

Chapter four further expands on question 3 and compares the results of the case study location survey with a survey of 857 people at 22 other locations within the catchment area of the zoo, but who had not visited the zoo. The chapter concludes that visitors to various attractions have changed behaviour following a visit but that visitors to the case study location are no more likely to do so than visitors elsewhere.

Chapter five examines question 4 and the influence of repeat visits over a number of years. The chapter examines the outcomes from a series of focus groups of annual pass holders to the case study location who had been visiting for a number of years. The chapter also examines comments on social media in response to a series of

questions raised during the focus groups on learning and requests for action. The chapter examines these participant's feelings about learning on a day out, whether it influences their behaviour and whether they have changed behaviour over the period they have been visiting. The chapter concludes that these frequent visitors who have multiple contacts over a number of years are highly engaged with conservation, are keen to know more and are open to calls to action, provided they understand the context.

Chapter six addresses question 5 using an extensive combined drawing and survey exercise with children in key stages 1 & 2, before and after formal educational visits, to evaluate learning. The chapter concludes that the children are learning on their visit and particularly misconceptions around animals are being corrected.

Finally the discussion and conclusion bring the various methodologies and results together to discuss the effectiveness of the case study location as an educational attraction and its potential for inspiring behavioural change in visitors. The results are discussed in the context of points 5 and 6 and the positive impacts of the charity's conservation activity and the negative impacts of running a large attraction. The potential for behaviour change in visitors to contribute to the overall environmental performance of the organisation is evaluated and a number of recommendations are made that outline how this might work in practise.

Chapter 2: Combining GPS and Survey data improves understanding of visitor behaviour

Abstract

Visitor tracking is frequently used as a tool in tourism planning for large tourist sites but is far less common at individual attractions, despite a body of literature examining the detrimental impact of crowding on visitor experience. A longer dwell time at animal enclosures has been shown to improve the visitor experience and learning opportunities. A means to determine dwell time across all exhibits, therefore has the potential to inform both public engagement campaigns and positioning of future exhibits. This study used handheld geographic positioning system (GPS) units to track 931 groups of visitors around a large zoo attraction to determine: where they went; how long they dwelt in particular locations, and whether different types of visitors behaved differently when exploring the attraction. Commonalities in route were found for all visitors revealing a strong 'main path inertia' when moving around the park with the majority of visitors missing the exhibits away from the perceived main route. Different group types varied in how long they dwelt at different locations and in how long they spent at the attraction altogether.

2.1 Introduction

2.1.1 Visitor tracking

Movement of people has been widely used by recreation planners at large, usually outdoor, tourist locations to manage transitory populations and ensure facilities are placed optimally (Cooper 1981; Pearce 1988). Understanding of tourist movement and behaviour can aid in targeted marketing (Chancellor and Cole 2008), help manage impacts associated with overuse or crowding (Russo 2002; Hallo *et al.* 2004), guide adjustments to transport systems (Shoval and Isaacson 2007; Edwards and Griffin 2013) and aid understanding of the visitor experience (Pettersson and Zillinger 2011; Sorensen and Sundbo 2014). Studies utilising visitor tracking at individual visitor attractions such as zoos, however, are few, and those that do exist focus on behaviour and movement around specific exhibits (Marcellini and Jenssen 1988; Ridgway *et al.* 2005; Francis *et al.* 2007). The complexities and labour intensive nature of following individual visitors, or groups of visitors, means little work has been done on visitor movement around these types of attraction as a whole.

The benefits of gaining a better understanding of visitor movements within an individual attraction include: evaluating effectiveness of exhibit design (Francis *et al.* 2007); examining circulation patterns for potential problems (Falk *et al.* 1985; Bitgood and Cota 1995); assessing visitors' needs, for example, for rest or sustenance (Davey 2006b); and to determine whether location specific information could enhance the visitor experience (O'Hara *et al.* 2007). A modern zoo exhibit, for example, is likely to have several view points and many interpretation features. When evaluating the effectiveness of the design it is important to know if all of these are being used by similar numbers of people for the same amount of time, or if some are favoured over others (Serrell 1998; Francis *et al.* 2007). The length of time a visitor spends at a single location (dwell time) is a key factor in their enjoyment of, and learning from, exhibits as it takes time to absorb information and relate it to what is being observed (Moss *et al.* 2008). Extending dwell time at exhibits and slowing movement, therefore, enhances the overall visitor experience (Davey *et al.* 2005; Ross and Lukas 2005; Gutwill and Allen 2010).

Visitor crowding occurs when the number of people in a location exceeds the visitor's expectations and restricts them from achieving their goals, whether that is observing the exhibit, relaxing with friends or taking in information (McManus 1998). Russo

(2002) highlighted the importance of managing access to the key locations that attract visitors to a tourist location and how understanding the spatial behaviour of visitors is essential to managing crowds at those locations. Local crowding at key exhibits can have a significant effect on a visitor's enjoyment and their perception of the carrying capacity of the attraction (McCool and Lime 2001; Manning *et al.* 2010). If all the visitors were concentrated at a small number of exhibits or at catering outlets, the visitor's perception of crowding is likely to be very different than if the same number of people were spread evenly over a variety of locations (McManus 1998). Within a zoo environment, crowding at animal enclosures is also likely to create stress for the animals as well as visitors (Carder and Semple 2008; Fernandez *et al.* 2009) and discourage people from stopping to observe the animals or take in information. Managing crowding is therefore essential, in the case of zoos to minimise stress to animals, and more widely for all attractions, to encourage visitors to spend longer at exhibits, allowing more time for observation and to absorb information provided. Bireboim *et al*.(2013) emphasised the importance of understanding the variation in temporal activity of visitors, as well as their spatial movement, to gain a better understanding of how behaviour varied over the duration of their visit. With a better understanding of visitor circulation the institution can take steps to spread visitors to less well used areas through better way-marking, elimination of bottle-necks or pinch-points and by providing more activities and facilities in popular areas (Fyall and Garrod 1998; O'Connor *et al.* 2005; Davey 2006b). Enhancing the visitor experience in this way should therefore lead to a more enjoyable day out, allow greater opportunities for learning and, hopefully, enhanced reputation, increased repeat visits and a greater number of personal recommendations (Santana-Jimenez and Hernandez 2011).

Traditional methods of studying visitor movements relied on post-visit questionnaires, recall maps or movement diaries (Potter and Manning 1984; Lew 1988; Pearce 1988; Hallo *et al.* 2004). These methods rely on the accurate recall of activity, time and positioning by the participants and hence are a relatively crude measure with wide margins of error (Lew and McKercher 2006; Shoval and Isaacson 2007; Beeco *et al.* 2012). Real-time travel diaries that participants complete throughout the duration of their visit, remove the error from poor recall (Pearce 1988; Fennell 1996) but may introduce a significant element of deliberate or subconscious bias on the part of the participant, who clearly knows they are being observed. Travel diaries also require considerable attention and effort on behalf of the participant which could detract from their enjoyment and hence influence their behaviour (Shoval and Isaacson 2007). Direct observational studies have also been used, where participants are followed or

observed from a distance, but the labour-intensive requirement of these means the sample sizes are inevitably small (Hartmann 1988). Geographic Information System (GIS) visualisation and analysis of data from visitor movement studies can be a very powerful tool (Chancellor and Cole 2008) but it relies on accurate positioning data to really come into its own (Pettersson and Zillinger 2011; Beeco *et al.* 2012). In recent years the continual reduction in price and increasing accuracy of hand-held geographic positioning system (GPS) units makes them a viable method of gathering accurate spatial and temporal positioning data on individuals at large, outdoor attractions (Hallo *et al.* 2012). Several studies have used GPS to assess visitor movements within very large areas, such as national parks or tourist-orientated towns (Thornton *et al.* 1997b; Modsching *et al.* 2009; Pettersson and Zillinger 2011; Edwards and Griffin 2013) but the use of GPS to examine visitor movements within a single attraction, covering a relatively small area is less well documented. In their comparison of different digital tracking methods, Shoval and Isaacson (2007) determined that the high resolution of modern GPS unit should be good enough to work in locations such as theme parks, but the need for continued sight of the sky may hinder observations. Recently studies in large attractions such as theme parks (Birenboim *et al.* 2013) and safari parks (Sorensen and Sundbo 2014) have shown that GPS is viable in these situations but highlight the difficulties in gaining a sufficiently large sample size for meaningful analysis.

2.1.2 Visitor segmentation

In studying how visitors use an attraction, an understanding of the different types of visitor is required (Birney 1988; Davey 2005). Various attempts have been made to categorise visitors to an area or attraction based on personality types (Debbage 1991), the activities they are interested in (Fennell 1996), on the amount of structure they place on their day (Beeco *et al.* 2012) and on their motivations for visiting (Falk and Storksdieck 2005; Falk 2006). Motivations for visiting may vary with the type of group a person is with, as well between individuals. A visitor with a group of friends may have anticipated a different experience than they would have had they visited with family and children (Crompton 1981; McManus 1987; McManus 1988; Thornton *et al.* 1997a). Parents visiting with children may be looking for an educational experience for their children, they may want to have some social time together as a family or they may simply be looking to take them out for fresh air and exercise. Their behaviour may also vary with the number of times a visitor has been to a particular attraction in the past (Kemperman *et al.* 2004) and their familiarity with what is on offer (Fallon and Schofield

2003). In particular, first time visitors will tend to wander more and visit all the main or 'signature' attractions of a location while repeat visitors will spend more time in supplemental activities such as retail or catering (Lau and McKercher 2004; McKercher *et al.* 2012).

Zoos tend to be very popular with families with younger children (Ocean Consulting 2007; BIAZA 2014) and children will have a significant influence on both the destination chosen and group behaviour once at a destination (Turley 2001; Wang *et al.* 2004; Carr 2006). Visitors may be looking for formal learning opportunities for children, such as talks or presentations, they may be engaged by open learning opportunities from interactive activities (Falk *et al.* 2008) or they may simply be looking for an entertaining day out (Tofield *et al.* 2003). Where learning is a desired outcome of the institution exhibit designs and their spatial positioning within the attraction needs to reflect these different motivations to engage different sections of the audience in different ways and maximise the learning opportunities.

Demographic variations may also affect visitor behaviour. Cooper (1981) found that the spatial behaviour of tourists varied with both socio-economic status and age. Lower income groups were thought to explore less in order to spend more time at fewer high reward locations and maximise the experience reward rather than visiting many sites with lesser experiences for a short time each. Lower income groups could therefore be expected to spend longer at an attraction than higher income groups in order to maximise the return from their day out.

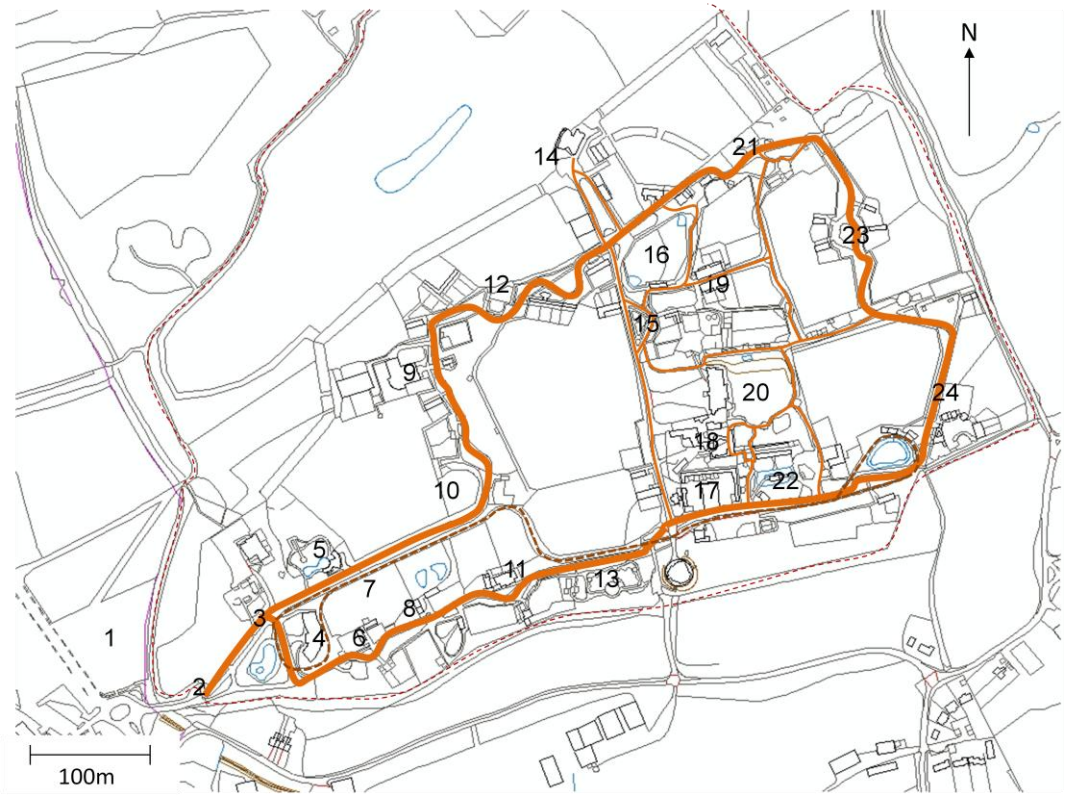
The purpose of the initial phase of this study was:

- To evaluate the effectiveness of handheld GPS as a means to track visitor groups around individual tourist attractions
- To evaluate visitor movements within an individual tourist attraction, examine the routes taken and determine if different areas of the attraction were used more or less than others
- To determine the influence group make up had on visitor behaviour, locations visited and routes taken
- To examine how visitor movements varied across the day and where crowding may occur

2.2 Case Study: Marwell Zoo

Marwell Zoo is a large (57ha) parkland zoo in Hampshire, UK. The size and layout of the zoo is comparable with other 'out of town' zoos in the UK without being so large as to require driving around as is the case in safari park style zoos. At the time of writing the zoo received approximately 400,000 visitors per year with the majority visiting in the spring and summer months from April to September and in October school half term. No previous work had been undertaken to understand visitor behaviour at this location

The layout of Marwell consists of a single large perimeter path with smaller paths crossing the central area (Figure 2-1). Many of the enclosures that Marwell considers to be the most popular are located along this perimeter path (e.g. Penguin, Giraffe, Tiger) while the inner areas are thought to be comparatively underutilised by visitors. The zoo specialises in African herbivores (such as Zebra, various antelope, Rhino, Giraffe, Somali Wild Ass) and hence the majority of the area of the zoo is taken up by large grassy paddocks forming mixed exhibits for these larger animals. Interspersed among the large paddocks are a wide range of other animals in discrete enclosures. A tractor pulled road train travels around this main perimeter path and a narrow gauge rail train ride runs alongside the paths on the southern side of the park. The zoo has two main catering outlets, one with indoor and outdoor seating and one with outdoor seating only.



1	Car Park	9	Giraffe	17	Tropical World
2	Entrance	10	Cheetah	18	World of Lemurs
3	Survey point	11	Pygmy hippo	19	Okapi
4	Gift shop	12	Amur leopard	20	Back lawn / gardens
5	Penguins	13	Snow leopard	21	Large playground
6	Anteater	14	Large, indoor cafe	22	Otter and gibbons
7	Capybara	15	Meerkat	23	Coati
8	Grey kangaroo	16	Amur tiger	24	Kiosk cafe & playground

Main path and tractor train route
Minor paths
Narrow gauge rail ride
Park boundary

Figure 2-1 Marwell Zoo layout showing key locations

2.2.1 Survey design

A two part survey was created to be conducted at the start and end of a visit to Marwell Wildlife, this chapter uses the entrance or greeting survey (Appendix 2:1). The survey design incorporated both demographic and motivational factors to characterise visitors (Rentschler 1998; Packer and Ballantyne 2002; Packer 2004; Falk 2006; Horn 2006; Dawson and Jensen 2011; Falk 2011). Demographic questions included: age, gender,

household income, education, pet ownership and whether they were members[6]. Group make up was categorised into one of eight group types based on staff expectations and previous internal surveys (Ocean Consulting 2007). These were: parents with children; larger family group; family and friends; grandparents with grandchildren; couples; groups of friends; carers or childminders and solo visitors. The number of individuals and age range of individuals in group was also recorded. Some participants preferred not to give certain details, such as income or education, in which case this section was marked accordingly and was noted in the spreadsheet as missing data.

Motivational factors for visiting the zoo were assessed using a series of Likert-type statements (Clason and Dormody 1994), based on those defined by Falk (2006). Visitors were asked how important the statements were when deciding to visit the zoo that day and were scored on a 5 point Likert-type scale from 1 (not important) to 5 (very important). Two statements were written to capture each of the five Falk (2006) categories (Table 2-1), and the remaining four covered motivations suggested by internal assumptions and previous internal visitor research (Ocean Consulting 2007).

[6] At the time the survey was carried out Marwell Wildlife sold annual passes for repeat visitors. These have since been replaced by a membership scheme hence annual pass holders are now referred to as members.

Table 2-1. Allocation of Likert-type statements to different visitor motivations (Falk 2006)

Falk identity based motivation category	Likert-type statement
Experience seeker or day-Tripper	It is one of the best places to visit round here
	I wanted some outdoors to go on a sunny day
Spiritual pilgrim	A visit to Marwell helps me to relax and unwind
	I feel at peace in these surroundings
Explorer - curiosity driven	Coming here helps me to appreciate the value of nature
	I want to learn more about wildlife
Facilitator	I like my family to experience nature / animals
	It's a good place to entertain the kids for the day
Special interest or hobbyist	I support the mission to study, celebrate and protect wildlife
	I like to draw / photograph animals
Other motivations assessed	
Nostalgia	I came a long time ago and want to revisit
Zoo or animal fan	I like to watch the animals
	I frequently visit zoos when I go on trips
Partner's choice	It was my partner / friends choice to come here today

The second part of the survey, the exit survey, will be analysed in later chapters.

2.2.2 GPS Units

Twenty Garmin Oregon 400t GPS units were used for the survey. On days with few visitors not all units were used and on a small number of days visitors leaving early meant the GPS units were available for a second use on the same day. Each unit was set to record its position every two seconds using the Universal Transverse Mercator (UTM) system.

2.2.3 Survey method

The surveys were conducted on 51 days between April 5th 2010 and October 30th 2010 with days stratified between peak days (school holidays, 44% of expected annual visitors) and intermediate days (term time April - Oct, 38% of expected annual visitors) according to expected visitor number variation throughout the year provided by the marketing department. No samples were taken during the off peak period (November - March, 18% of expected annual visitors) due to time constraints and unpredictable weather conditions. During term time the majority of visitors visit at weekends so preference was given to weekend days during these periods. During school holidays there is less variation between weekend and weekday visitor numbers so a more even split of days was chosen. Table 2-2 shows the distribution of survey days across the survey period.

Table 2-2. Distribution of survey days

	Number of days
Weekdays, term time	5
Weekends, term time	18
Weekdays, school holiday	15
Weekends, school holiday	11
Bank holiday Mondays (all during school holidays)	2
Total	51

The majority of visitors arrive between 10am and 1pm at which point arrivals tail off (Figure 2-2). On busy days this tail can be long, but even on these busy days 80% of visitors will have arrived by 12:30pm. Surveys were therefore spread evenly across this period by sampling at approximately 5 - 10 minute intervals from opening time. This interval varied depending on the number of refusals and number of visitors arriving.

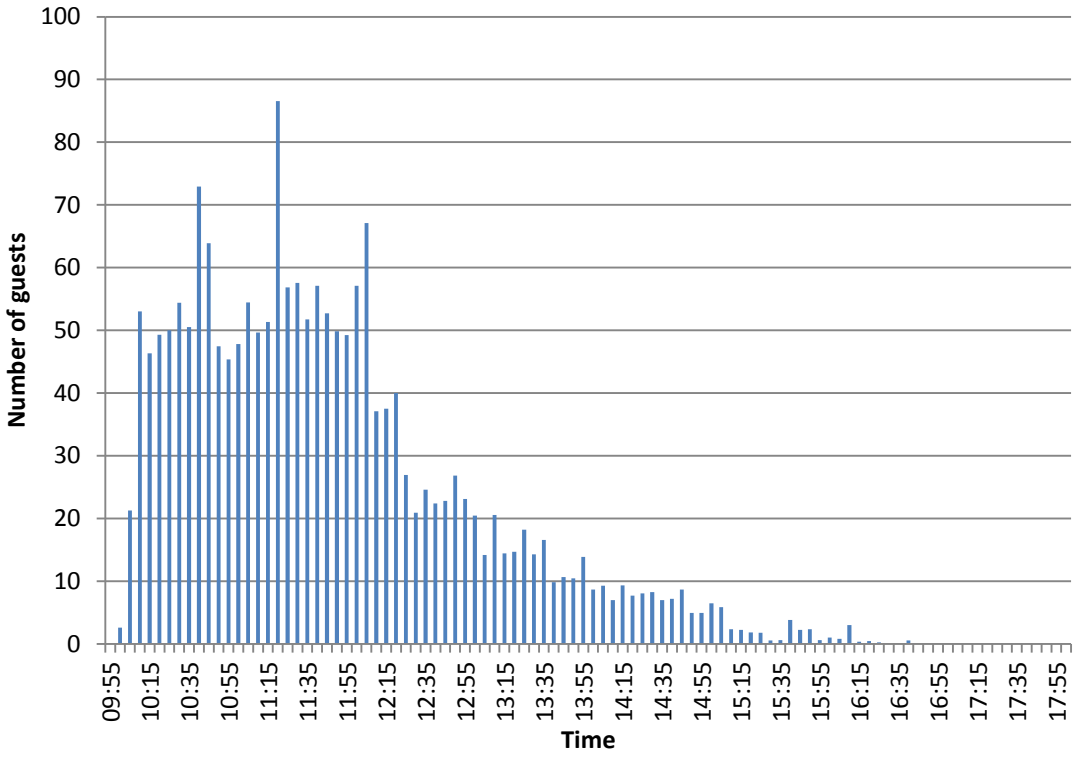


Figure 2-2 Ticketing data showing number of visitors arriving during 5 minute intervals averaged over 7 days, 1st - 7th June, 2010 (school term time in the UK).

Visitors were selected at random at the survey station positioned approximately 50m inside the park. One participant from each group was asked to both complete the survey and to take the GPS tracker so that the same person was answering questions and being tracked in case a group split up during their day. The GPS units were set to record their positions at two second intervals. Participants brought the GPS units back as they exited the park. A random sample was obtained by preparing the survey form and GPS unit then selecting the next group to pass a preselected point (litter bin) approximately 15m in front of the survey point and then approaching them as they passed the survey point. If this group declined to take part, the next group passing the selection point was approached. As many groups passed by while waiting for the selected group to arrive, this method was considered to produce a sufficiently random sample, however self selection bias on the part of the participants could not be ruled out (Fink 2003). The composition of the groups declining to take part was estimated visually and was found to contain a higher percentage of parents with children than the survey group (62% vs 47%) so although parents with children were the largest group taking part in the survey, these may in fact have been underrepresented compared with the total visitor population (Appendix 2:2). The reasons given for not taking part are shown in Appendix 2:3.

Participants brought the GPS units back as they exited the park and completed the exit survey.

2.2.4 Data handling and analytical approach

A total of 1005 groups took part in the survey and 635 declined. Demographic data on participants is shown in Appendix 2:4. Results of the Likert-type questions on motivations for visiting are shown on page 2 of the greeting survey in Appendix 2:1.

GPS data was analysed using ArcGIS. Data from the GPS units was downloaded at the end of each day and converted to shapefiles to project the points onto the park map using the UTM zone 30 North co-ordinate system (Figure 2-3). There were some reliability issues with the GPS units resulting in no track being recorded for individual units on some days. In total 999 GPS tracks were recorded from the 51 days. Of these, 57 showed some form of data inconsistency such as: gaps in the data where satellite signal was lost; changes in the data collection frequency or data collection stopping before the visitor returned to the start / finish point. These incomplete tracks were also removed from the data set. On analysis of the survey data it was found there were only 10 participants in the category of Career / childminder and 1 in the solo category. This resulted in very high variance for this small sample, so tracks and survey data for this group were also removed from the analysis, leaving 931 complete tracks and survey data for further analysis.

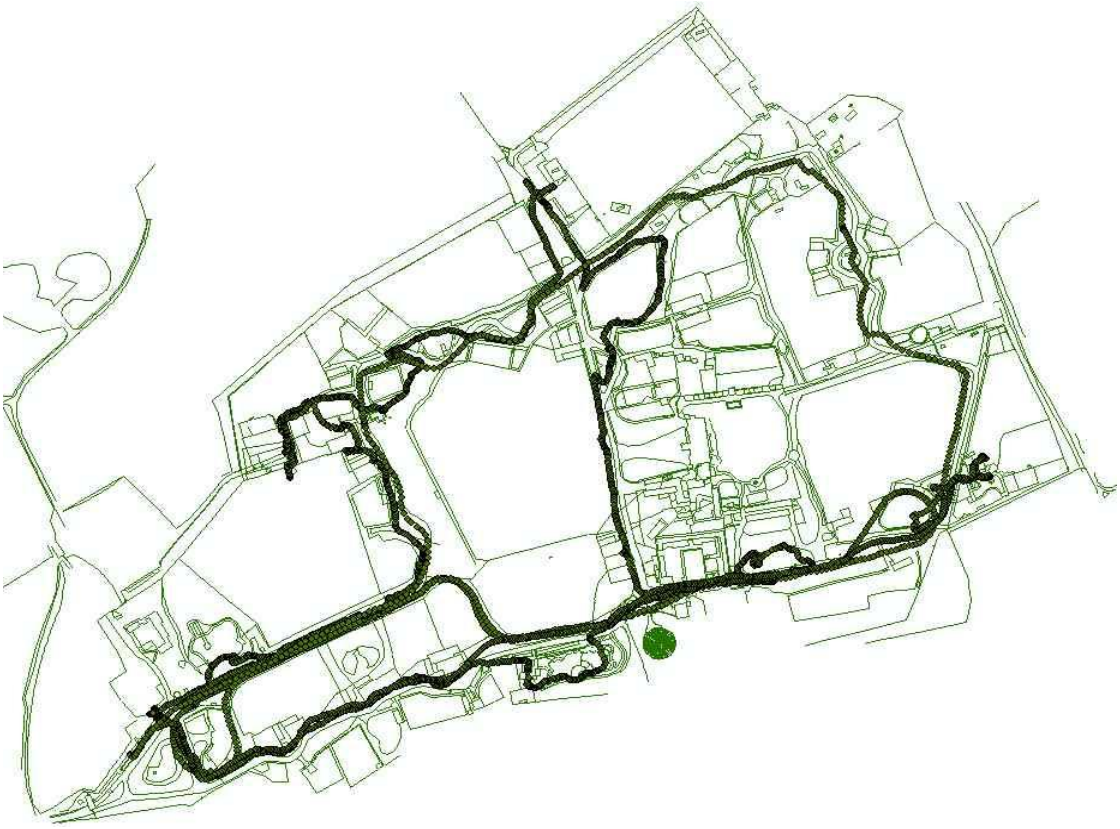
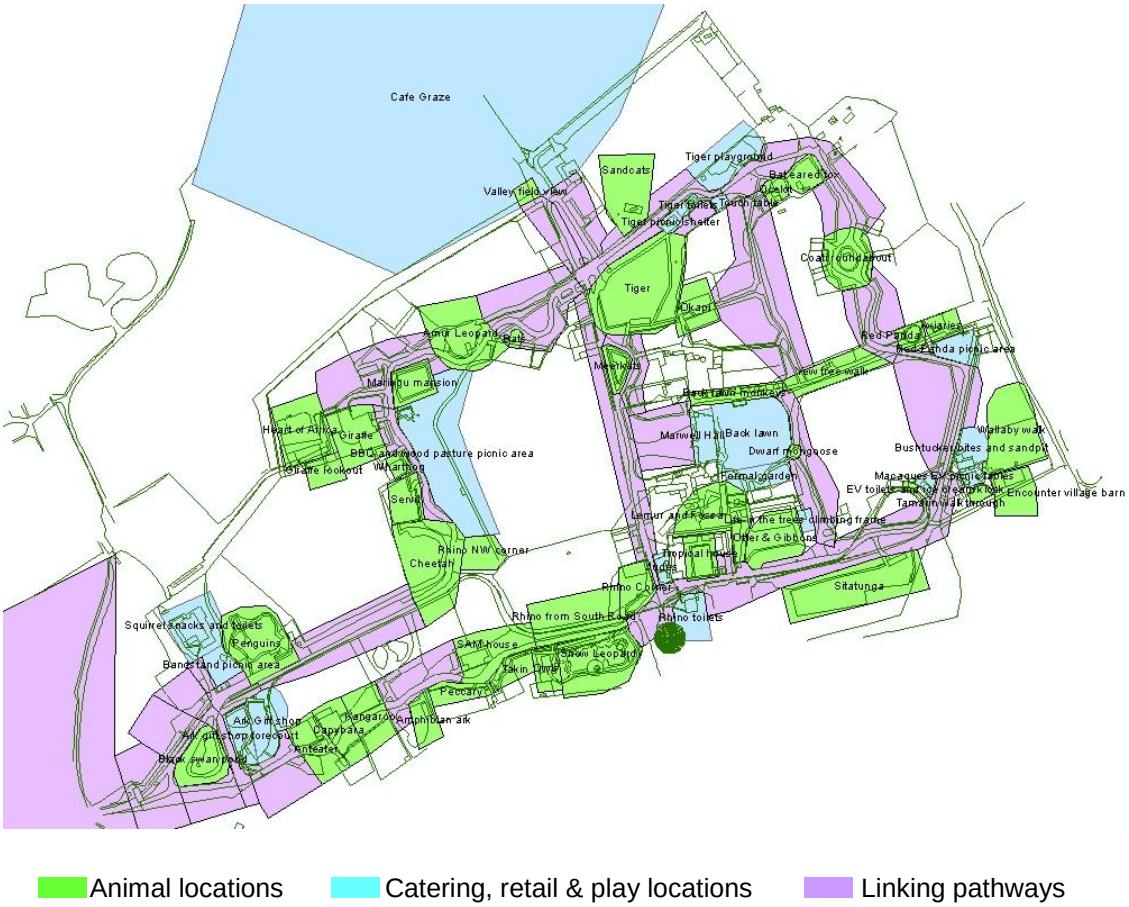


Figure 2-3. Example GPS track (green dots) overlain on park plan with data points recorded at 2 second intervals

The accuracy of the GPS units was affected by the buildings that participants entered and by dense tree cover. Accuracy in the more open areas on the north side of the park was typically ± 5m whereas on the south side of the park, adjacent to the woodland, accuracy was in the region of ± 8 to 10m. This resulted in many of the tracks appearing to be off the footpaths. Usually it was possible to recognise which path the participants were on due to the large separation of footpaths which in all areas is much greater than 10m. This positioning error meant that it was not always possible to tell if a participant was at a specific enclosure or the adjacent one. In those cases where the participants could not definitively be said to be at a particular location, that location was not included in the cumulative animal enclosure location analysis. For the bulk of the park, where spacing of enclosures was sufficient to allow distinction between them, capture polygons were drawn larger than the enclosure, using kernel density maps as a guide, to ensure all participants passing any particular area were included (Figure 2-4).



Animal locations Catering, retail & play locations Linking pathways

Figure 2-4. Park map showing identified locations for analysis.

A category termed ‘linking pathways’ was use to capture all locations where it was not possible to determine what the participant was doing. The results for time spent at animals will therefore be lower than was actually the case. This error should be the same for all groups and hence should not negate the differences in behaviour found but the reduction in resolution means differences may exist which are not found. This type II (false negative) error is considered preferable to including the doubtful areas in the animal area count and risking a type I (false positive) error.

Intersection and frequency analysis was performed for each GPS track and the polygons for animal enclosures, non-animal attractions (catering, play, picnic and retail) and linking pathways. The counts of points at each location were then converted to time at each location by multiplying number of points by two seconds, resulting in a list of times at each location for each track.

Many of the animal enclosures at Marwell are large, with a viewing area spread along the main path. Traditionally in visitor tracking studies, the visitor is recorded as viewing an exhibit when they have been stationary and facing the exhibit for two or more

seconds (Serrell 1998). Serrell (1998) used the sweep rate index (SRI) to relate dwell time to exhibit area and thus allow for comparison between exhibits. Whilst this is effective for indoor exhibits with an easily defined area, it is less effective with larger outdoor exhibits where the exhibit area is not so easily defined and a good view of the animal could be had without a stationary period. An alternative measure of ‘interaction’ or 'attending to' was therefore used which allows for slowing to look without stopping, but which excludes those passing by (Yalowitz and Bronnenkant 2009). This measure also excluded passengers on the road or rail train travelling on, or adjacent to the paths. To gain a measure of the time taken to pass each exhibit without looking, visitors were observed walking past enclosures and the time taken to pass each enclosure without slowing or stopping to look recorded. This 'walking past' time was subtracted from the dwell time at each location, as recorded on each GPS track, to produce a table of ‘interaction' or 'attending to' times which give an indication of the time spent specifically interacting with a particular area. All negative times resulting from this calculation, due to visitor passing more quickly, including on the train, were rounded up to zero and the visitor was assumed not to have paid attention to that exhibit.

Birenboim *et al.* (2013) advocated the use of functional descriptors to categorise locations and allow comparison between different tourist attractions containing similar functional elements. They divide their functional elements into tangible products (in their case rides and shows) and augmented products (catering, retail, customer service) using Kotler (1997) as a guide. In this study interaction times were examined both at individual animal exhibits and at aggregated functional locations defined as: tangible product locations (animal exhibits) and augmented product locations (catering, picnic, play and gift shop). This time at location data was combined with the survey and weather data for analysis of statistical significance of differences seen. The total distance covered was also recorded from the GPS tracks and combined with the survey data for analysis.

2.2.5 Statistical tests

The time spent at specific locations and cumulative time spent in aggregated locations did not show either a normal distribution or homogeneity of variance hence the non parametric Mann-Whitney U test was used to analyse the relationship between visiting specific locations and time spent in the park.

Variants of generalized linear models (GLM & GLMM) were initially considered for a fuller analysis to examine the variation in dwell time with demographic differences and group type. Exploratory analysis, however, showed that the responses were neither simple, linear nor interaction-free and the various assumptions could not be met for the wide range variables assessed. A model using boosted regression trees, a modern robust method from machine learning that makes very few assumptions about the data (Hastie *et al.* 2009) was therefore used instead. This machine learning technique fits many decision tree models and combines the most appropriate to arrive at the best predictive model possible from the data available. The specific model used here was a Gaussian boosted regression tree (BRT) model, fitted using the R package gbm 2.1.1 (Ridgeway 2015) and the extra routines supplied by Elith *et al.* (2008). The maximum number of trees was set to 10,000, bag fraction = 0.5, tree complexity 5 and learning rate 0.001. Ten-fold cross-validation optimisation of the model was performed using Elith *et al.'s* (2008) step.gbm routine.

The boosted regression tree model was constructed with a total of 33 factors: 21 describing the participant and their party taken from the survey data; 5 relating to the day of their visit (day of the week, closing time, holiday or term time, in park events and external events happening that day) and 7 describing the weather conditions on that day.

The point shape files were merged into a single file consisting of circa 7,500,000 points with each point matched with the survey responses given by the relevant participant for analysis of variations in locations visited with the survey responses. With points recorded at two second intervals, a high point count equates to high dwell times at that location.

Kernel density analysis was used to highlight the variation in time spent in particular areas of the park for all visitors and for specific groups of visitors. The kernel density maps were produced using an output raster cell size of 5x5m and a search radius of 40m. Effectively the GIS software fits a smooth curved surface over each point and then counts how many of the points fall within the search radius based on that curved surface. A point falling within the output cell counts as one point, a point falling outside of the cell, but within the search radius, is counted as a fraction of a point depending on the fitted curved surface and the distance away from the output cell. The resultant map shows areas with high point counts showing up as increasingly darker patches with increasing point counts.

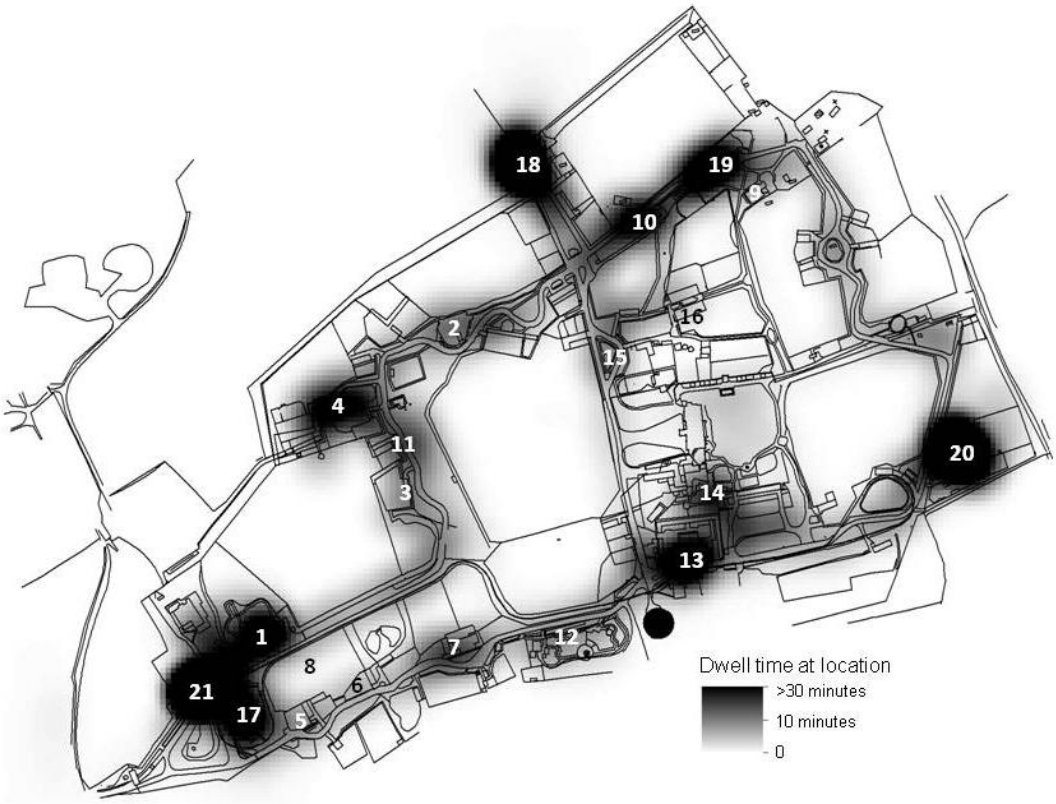
Kernel density analysis was also used to compare the behaviour of different categories of visitor, as defined by their demographic and group type categorisation. Comparison between different combinations of groups of visitors was achieved by normalising the kernel density maps for each group to a scale of 0 – 1 and then subtracting the density map of one group from another. The resulting density difference maps have a midpoint of zero, which represents no difference in dwell time between the two groups under analysis, and is coloured grey on the maps. Differences in dwell time between the groups being assessed show up as shading variation away from the grey midpoint. If the first group dwells longer in a particular location than the second group, that location will show up brighter / whiter than the area of no difference. Conversely if the second group dwells longer than the first, the area will show up darker / blacker than the surrounding area of no difference.

The responses to the pairs of Likert-type statements for each motivational category (Table 2-1) were averaged to produce a single response for each category. This was also combined with the GPS data for mapping in ArcGIS and for analysis of differences between groups.

2.3 Results

2.3.1 Variations in locations visited and dwell time for all visitors

Kernel density analysis of the 7,500,000 points and subsets of these points show where the participants spent their time (Figure 2-5). The majority of the time was spent around the perimeter path with fewer people venturing along the smaller paths in the centre of the park. All of the top 12 most visited locations were on the main perimeter pathway while exhibits such as the Meerkat and Okapi in the central areas were missed by over 50% of guests (Table 2-3). The main cafe (Cafe Graze) was the most visited augmented product location, closely followed by the gift shop and playgrounds (Table 2-4).



1	Penguins	8	Coati	15	Meerkat
2	Amur Leopard	9	Serval	16	Okapi
3	Cheetah	10	Amur Tiger & picnic shelter	17	Gift shop
4	Giraffe	11	Warthog	18	Large indoor cafe
5	Giant anteater	12	Snow Leopard	19	Large playground
6	Grey kangaroo	13	Tropical House	20	Kiosk cafe & playground
7	Pygmy hippo	14	Lemurs	21	Start & finish point
8	Capybara				

Figure 2-5. Kernel density analysis of all visitors showing areas of longest stay as darker shading

Table 2-3. Proportion of participants visiting animal locations and the mean dwell time for all visitors at each

Location	No of visitors	Percentage of visitors	Mean dwell time (min)	SD
Penguin	920	98%	9.76	6.93
Amur Leopard	916	97%	4.12	3.14
Cheetah	900	96%	4.31	3.60
Giraffe	874	93%	4.17	4.21
Anteater	850	90%	1.53	1.59
Kangaroo	839	89%	1.04	1.19
Semi-aquatic mammals (pygmy hippo)	774	82%	2.87	2.88
Capybara	744	79%	0.59	0.76
Coati	744	79%	2.63	2.65
Servil	734	78%	1.46	1.48
Tigers	725	77%	9.31	10.14
Wharthog	721	77%	1.06	0.89
Otter and Gibbon	686	73%	4.55	4.11
Snow Leopard	673	72%	3.27	2.94
Heart of Africa	642	68%	5.25	3.27
Sandcats	604	64%	2.77	1.53
Owls	600	64%	1.50	1.35
Red Panda	598	64%	1.48	1.18
Tropical house	568	60%	7.26	4.42
Rhino Corner (main rhino view point)	553	59%	1.86	2.62
World of Lemurs	508	54%	11.08	7.22
Reptile barn	485	52%	4.90	3.99
Rhino (viewed from south)	475	51%	1.62	1.87
Ocelot	462	49%	1.83	1.46
Bat eared fox	461	49%	1.08	0.93
Wallaby walkthrough	447	48%	4.20	4.13
Meerkats	442	47%	3.82	3.55
Giraffe lookout	386	41%	1.98	1.42
Valley field view	365	39%	6.16	11.50
Tamarin walkthrough	356	38%	1.19	1.47
Aviaries	344	37%	1.02	1.33
Amphibian ark	336	36%	1.22	0.90
Maribou mansion	314	33%	1.02	1.60
Bats	253	27%	0.58	0.78
Okapi	250	27%	3.54	2.36
Macaques	204	22%	1.53	1.59
Takin	190	20%	0.77	0.91
Back lawn monkeys	173	18%	3.85	3.37
Peccary	171	18%	1.05	1.34
Yew tree walk	167	18%	1.99	1.45
Dwarf mongoose	58	6%	1.07	1.93
Sitatunga	38	4%	5.64	12.36

Table 2-4. Proportion of participants visiting augmented product locations and the mean dwell time for all visitors at each

Location	No of visitors	Percentage of visitors	Mean dwell time (min)	SD
Cafe Graze	539	57%	26.20	19.16
Ark Gift shop	525	56%	7.16	8.15
Tiger playground	487	52%	14.72	12.76
Bushtucker bites cafe and sandpit	424	45%	22.40	18.60
Red Panda picnic area	412	44%	3.55	9.69
Squirrel snacks and toilets	334	36%	7.02	8.36
Tiger picnic shelter	331	35%	4.66	10.75
BBQ and wood pasture picnic area	241	26%	15.25	15.29
Judes (Ice cream outlet)	238	25%	6.67	9.26
Bandstand picnic area	234	25%	6.84	16.64
Back lawn	173	18%	11.51	22.36
Formal garden	132	14%	2.32	3.54
Life in the trees climbing frame	123	13%	2.48	4.08

The tendency of the majority of visitors to follow the perimeter path (Figure 2-1) in a clockwise direction resulted in large concentrations of visitors in different areas of the zoo at different times of the day (Figure 2-6) with the areas visited in the morning almost empty by early afternoon. For example over 80% of the visitors who went to the Giraffe exhibit did so before 1pm (Figure 2-7). Throughout the day, however, the density of visitors to the central areas of the zoo remained low (Figure 2-5 & Figure 2-6). Those visitors who did visit the locations in this central area, such as the Meerkat and Okapi enclosures, were those who spent more time in the park overall and spent more time looking at animals (Table 2-5).

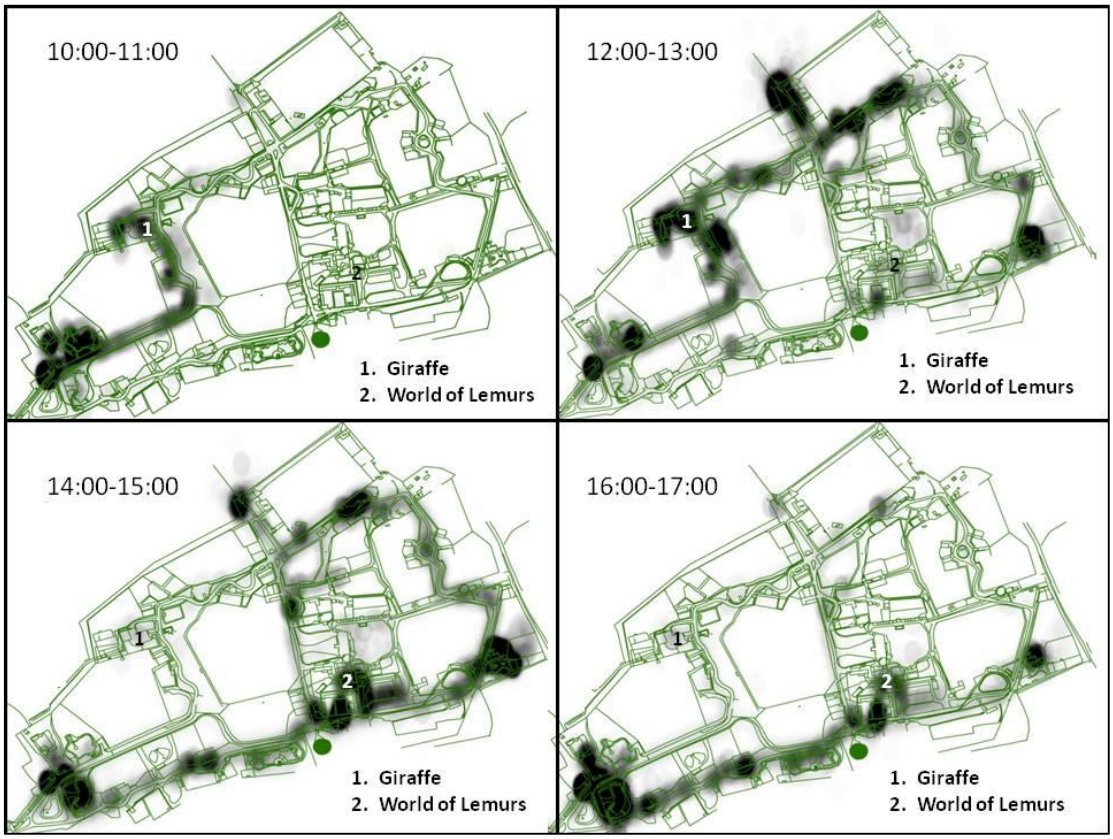


Figure 2-6. Kernel density maps showing concentrations of visitors during four 1 hour time periods throughout the day

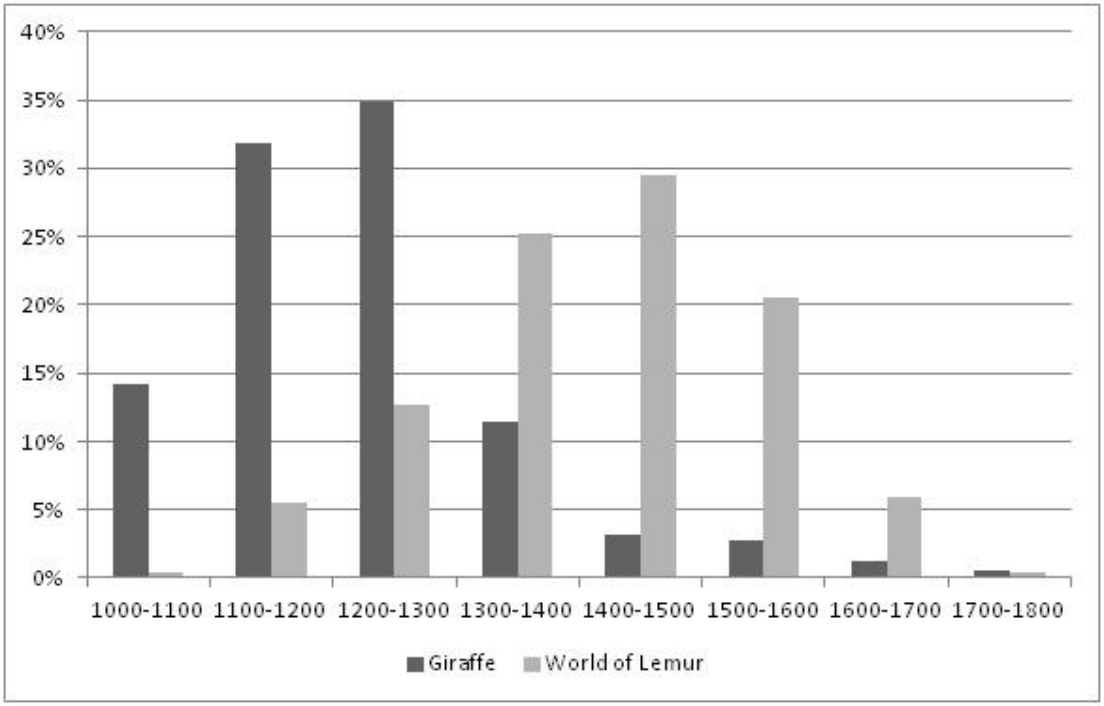


Figure 2-7. Percentage of visitors to the Giraffe exhibit and World of Lemurs for each hour of the day

Table 2-5. Comparison of time spent in the park for those who did, and did not, visit two key animals that are located off the main path (IQR = interquartile range)

Animal location	Visited location (time in minutes)		Did not visit location (time in minutes)		Mann Whitney U		
	Median	IQR	Median	IQR	z	p	r
Meerkat	n = 440		n = 491				
Total time in park	254	100	225	103	5.804	< 0.001	0.19
Time spent at animals	88	55	65	43	9.311	< 0.001	0.31
Okapi	n = 247		n = 684				
Total time in park	257	98	235	99	3.719	< 0.001	0.12
Time spent at animals	93	53	68	46	8.424	< 0.001	0.28

Significant variations in total time spent at the zoo and distance travelled were found. The mean time spent in the park for all visitors was 238 minutes (SD 71) and the mean distance covered was 5,516m (SD 1,728). The shortest time spent in the park was a family of four with two young children who stayed for only 55 minutes and covered 1,387m. The longest time spent in the park was by a group of four people in the category 'family and friends' who stayed for 461 minutes and covered 9,586m while the longest distance covered was 14,117m, also by a group of four in the 'family and friends' category, who stayed for 419 minutes. Time spent ‘attending to’ the animals was approximately a third of the total time in the park (Table 2-6) with a further third spent at non-animal locations, and the remainder walking between exhibits and at the exhibits that could not be resolved by this method. This ratio is comparable with other studies, for example Birenboim *et al.* (2013) who found only 40% of visitor time was spent at identifiable locations, but still leaves a significant proportion of the visitors day unaccounted for.

Table 2-6. Dwell time in minutes as recorded by GPS units at different location types

	N	Minimum	Maximum	Mean	SD
Animals	940	7.45	221.92	79.82	37.30
Catering outlets	847	0.02	146.20	34.10	24.19
Playgrounds	671	0.02	114.02	25.29	23.15
Picnic sites	862	0.02	128.95	10.48	17.76
Ark Gift shop	525	0.03	77.37	7.16	8.15

2.3.2 Variation in locations visited with demographic variation

Group type, travel distance, number of previous visits and group size were the major factors in determining how long people stayed in the park (Figure 2-8) with the larger groups spending more time in the park than smaller ones.

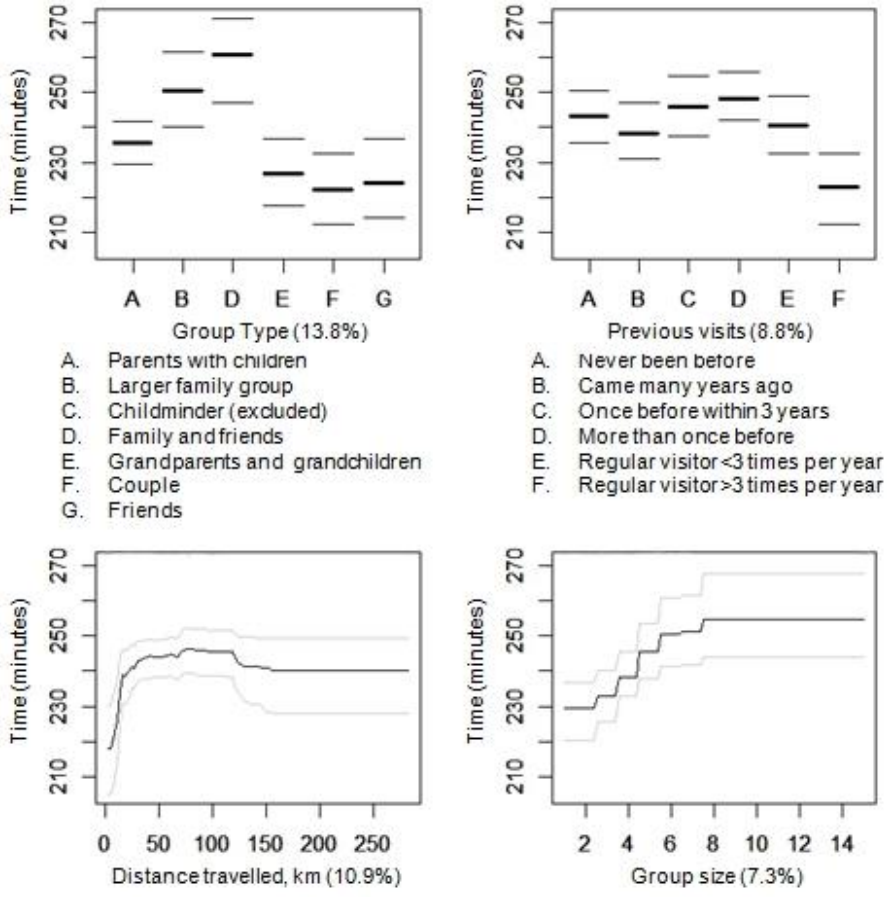


Figure 2-8. Partial dependence plots for the top four variables affecting variation in total time in the park with 95% CI. Relative contribution is given in parenthesis

Overall the larger groups consisting of large families or family and friends spent the longest in the park while the most frequent visitors (>3 visits per year) spent the least

amount of time. The larger groups account for nearly a third of all visitors while the most frequent visitors account for a quarter of all visitors to Marwell Zoo each year (Table 2-7).

The total amount of time spent in the park was shortest for those who travelled the shortest distance to get there. This increased rapidly as distance increased and reached a plateau between 50 and 120 km travel distance before reducing again (although the latter is within the 95% confidence interval for distances less than 120 km). The total time model explained 45.9% of the deviance using the training data (explanation of observed data) and 25.6% of the deviance using the cross validation (CV) data (prediction of left-out or test data).

Table 2-7. Number of participants categorized by group type (excluding solo visitors and careers/childminders) and by number of previous visits

Group type	Parents with children	Larger family group	Family and Friends	Grandparents with Grandchildren	Couple	Friends
No. of responses	472	178	118	78	121	26
Percentage	47%	18%	12%	8%	12%	3%
Previous visit	Never	Many years ago	Once within 3 years	More than once before	Regular < 3 times per year	Regular > 3 times per year
No. of responses	190	151	60	246	101	255
Percentage	19%	15%	6%	24%	10%	25%

The number of previous visits, travel distance, membership and household income had the largest affect on how long participants spent interacting with animals (Figure 2-9).

The most frequent visitors and members spent the least amount of time attending to animals. There was a positive correlation (Spearman's rho = 0.713, $p < 0.01$) between membership and frequency of visits and a negative correlation (Spearman's rho = -0.416, $p < 0.01$) between membership and distance travelled to reach the zoo (i.e. members were the most frequent visitors and lived closer to the zoo).

Several of these key variables were found to overlap. Household income had a low negative correlation (Spearman's rho = -0.103, $p < 0.01$) with the length of time spent attending to animals (Figure 2-9) with those in the higher income groups spending less time attending to animals. There was a low correlation between income and number of previous visits with those in lower income brackets visiting the zoo less often (Spearman's rho = 0.093, $p < 0.01$) and between income and membership

(Spearman's rho = 0.105, $p < 0.01$) with those in lower income brackets less likely to be members.

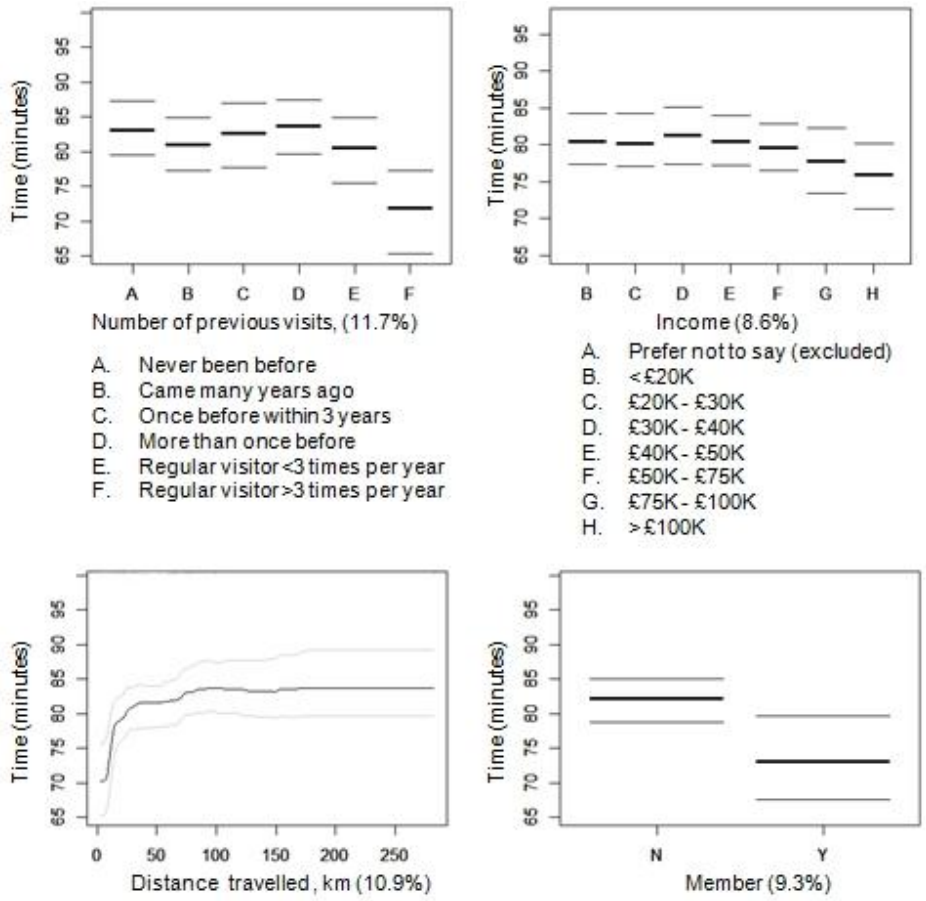


Figure 2-9. Partial dependence plots for the top four variables affecting variation in time spent attending to animals with 95% CI. Relative contribution is given in parenthesis.

The animal time model explained 38.0% of the deviance in time attending to animals using the training data (explanation of observed data) and 19.8% of the deviance using the cross validation (CV) data (prediction of left-out or test data).

The amount of time spent at the augmented product locations was particularly influenced by the presence of children under the age of 12 in the group, with household income, education level and distance travelled having a lesser effect (Figure 2-10).

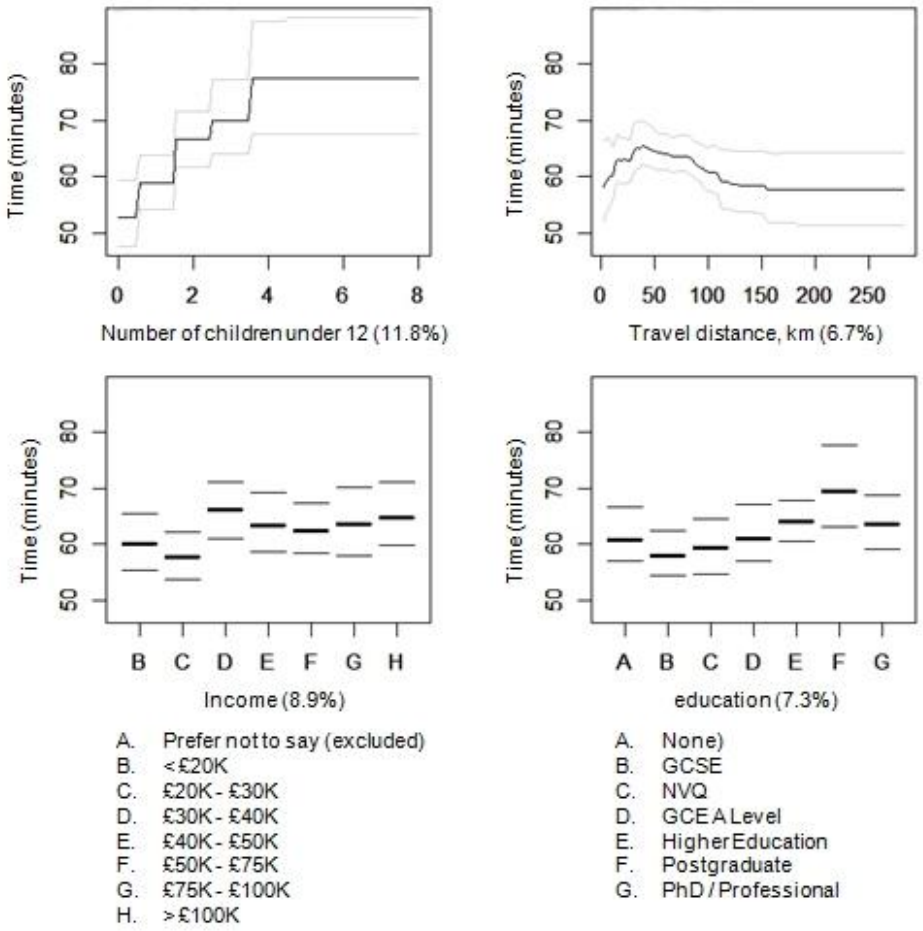


Figure 2-10. Partial dependence plots for the top four variables affecting variation in time spent at augmented product locations with 95% CI. Relative contribution is given in parenthesis.

The augmented product time model explained 43.5% of the deviance in the time at augmented product locations using the training data (explanation of observed data) and 20.1% of the deviance using the cross validation (CV) data (prediction of left-out or test data).

Kernel density analysis highlighted the variations in behaviour between the differing group types and at which locations different group types spend their time. Figure 2-11, for example, shows the variation in dwell time across the zoo comparing the groups which did not include children (couples or groups of friends) with the other groups, all of which include children within their parties. Locations where those groups not including children dwelt for longer are shown as lighter coloured areas and locations where those including children dwelt for longer are shown as darker coloured areas. The light coloured areas are predominantly animal locations while the dark coloured areas are predominantly the augmented product areas (picnic, catering and playgrounds). Those groups that did not include children spent a larger proportion of their day attending to

animals (mean 46%, SD 10%) than the other group types which all included children (mean 32%, SD 12%) (Figure 2-12). Conversely the groups with children spent a larger proportion of their day at the augmented product sites than those without. The BRT analysis found that the number of children under the age of 12 was the most important factor in the proportion of total time spent at the augmented product sites accounting for 31% of the variation in this variable. Group type was not found to be one of the main causes of variation in time attending to animals in the BRT analysis but it was found to have a smaller effect accounting for 7.7% of the variation in this variable. The small family groups consisting of parents with children, and particularly grandparents with children, were found to spend less time attending to animals during their visit (Figure 2-13). These groups are a significant audience for Marwell making up over half of all visitors in this study. Overall over 85% of all visitor groups include children (Table 2-7).

1	Penguin	5	Large playground	8	Lemurs
2	Giraffe	6	Tigers and Meerkat	9	Tropical World
3	Picnic area	7	Kiosk cafe & playground	10	Otter and gibbons
4	Large indoor cafe			11	Snow leopard

Figure 2-11. Variation in dwell time between groups that include children (dark areas) and those that did not (light areas).

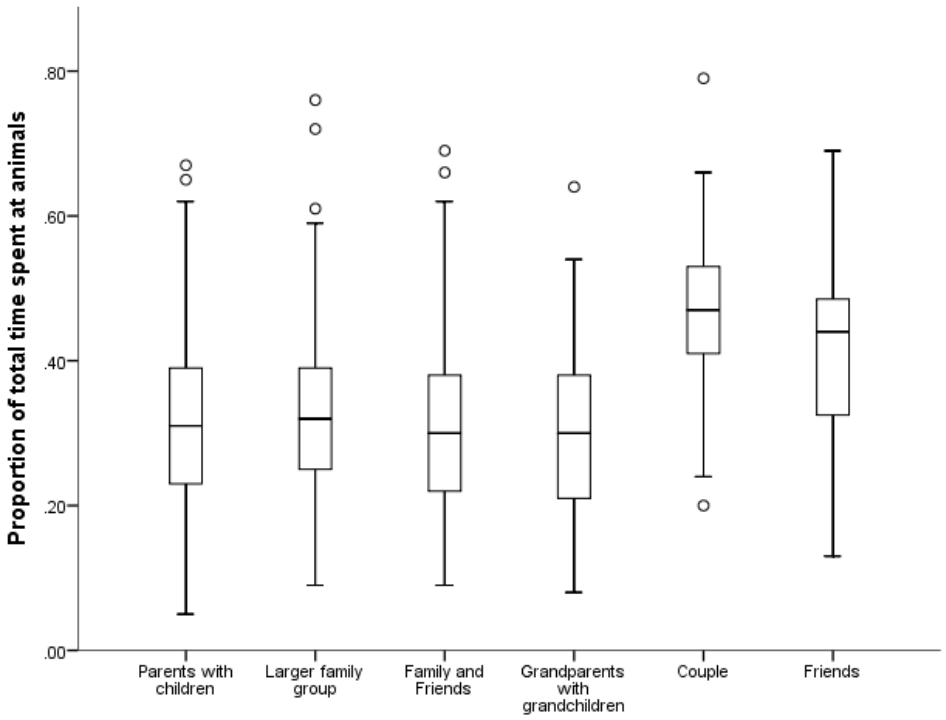


Figure 2-12. Variation in proportion of total time spent attending to animals by group type

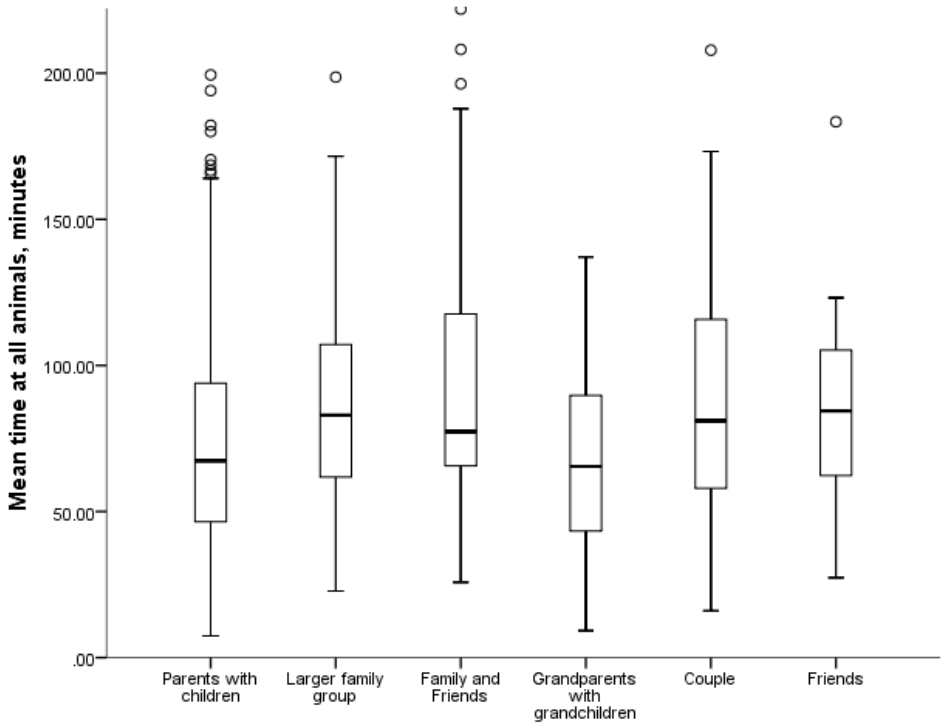


Figure 2-13. Relationship between group type and time spent attending to animal exhibits

2.3.3 Motivation

Comparison of visitors categorised by motivation was found to show less variation than between group types with no significant differences in time paying attention to animals, total time in the park or distance travelled between the various motivational categories. Low levels of correlation were identified, however, between how much visitors agreed or disagreed with particular motivations and the time spent attending to animals (Table 2-8). The special interest / hobbyist group showed the greatest correlation with time at animals. Those who identified most strongly with this group spent around 30% longer at animals than those who least identified with this group (Figure 2-14). The variation seen in time spent at animals was positively correlated with increasing agreement with special interest statements although the correlation was low (Table 2-8).

Table 2-8. Correlation between motivations for visit and time attending to animals

Visitor categorisation	Correlation with time attending to animals (Spearman's rho)		
	rho	p <	n
Experience seeker or day-Tripper	-0.075	0.05	939
Spiritual pilgrim	0.0	Not significant	940
Explorer - curiosity driven	0.135	0.001	937
Facilitator	-0.083	0.05	940
Special interest or hobbyist	0.156	0.001	940
Zoo or animal fan	0.127	0.001	940

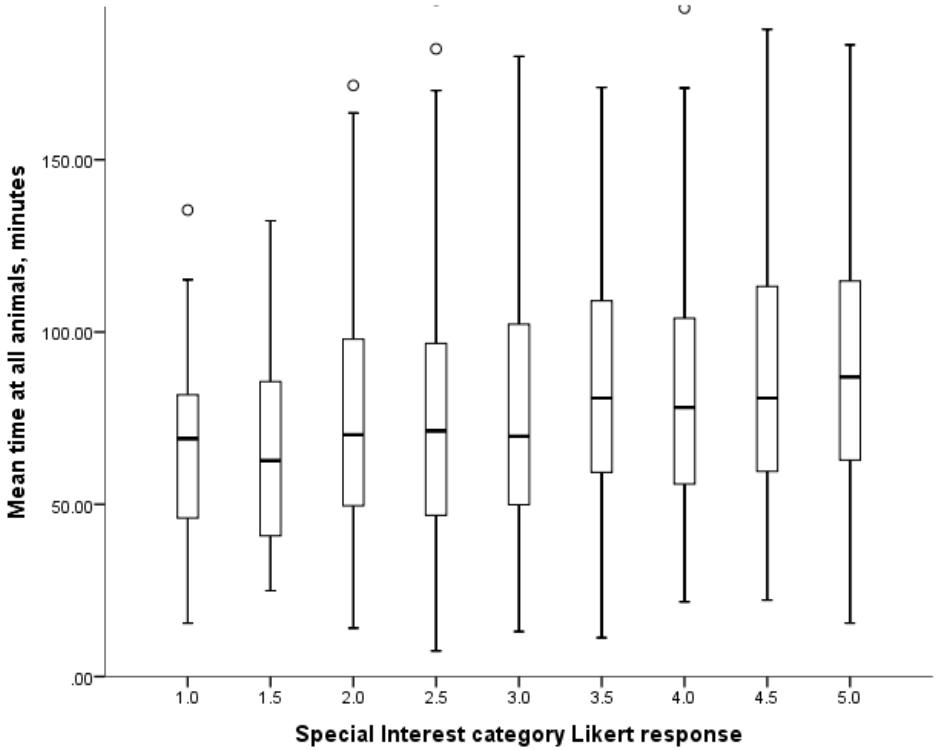


Figure 2-14. Variation in time spent attending to animals increases for those agreeing more strongly with 'Special interest' statements.

Variation was also seen with how much participants identified with the facilitator statements. The variation seen in time spent at animals for the facilitator group was quite small, however, the kernel density maps comparing those who identified as facilitators and those who did not showed notable bright spots at non animal locations indicating more time spent in these areas and less time at animal locations (Figure 2-15). Variation in time spent at playgrounds and catering outlets for this group (Figure 2-16 & Figure 2-17) showed a significant correlation with how much the participant identified as a facilitator (Playground: $r = 0.225$, $N = 940$, $p < 0.001$, Catering: $r = 0.137$, $N = 940$, $p < 0.001$).

1. Bandstand picnic
2. Wood pasture picnic
3. Cafe Graze
4. Tiger picnic
5. Tiger playground
6. Hall lawn picnic
7. Cafe and playground
8. Ice cream
9. Holiday crafts
10. Meerkat and Tigers
11. World of Lemurs
12. Tropical house
13. Otter and gibbons

Figure 2-15. Dwell time variation between people who identified as ‘Facilitators’ and those who did not.

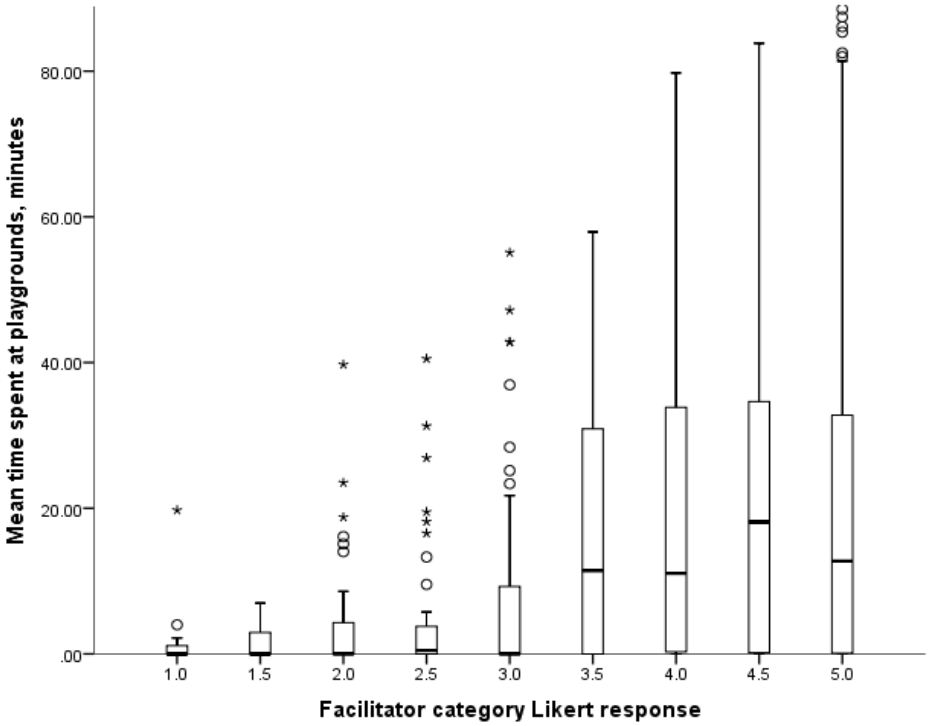


Figure 2-16. Variation in time spent at playgrounds increased for those agreeing more strongly with 'Facilitator' statements.

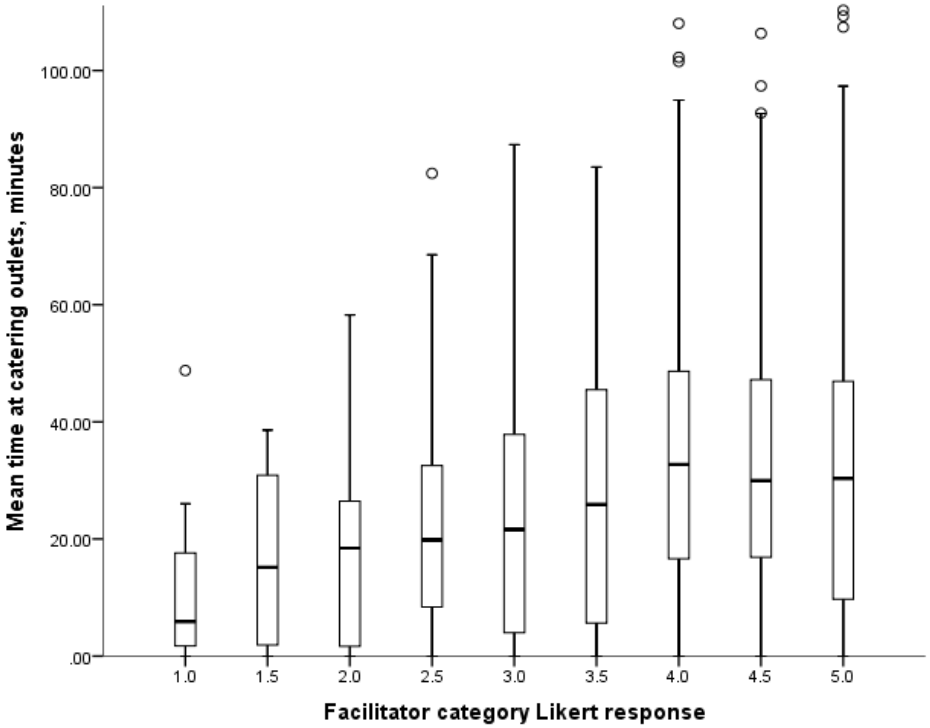


Figure 2-17. Variation in time spent in catering outlets increased for those agreeing more strongly with 'Facilitator' statements.

Those who strongly identified with the facilitator motivation were predominantly the family groups, particularly parents with children (Figure 2-18).

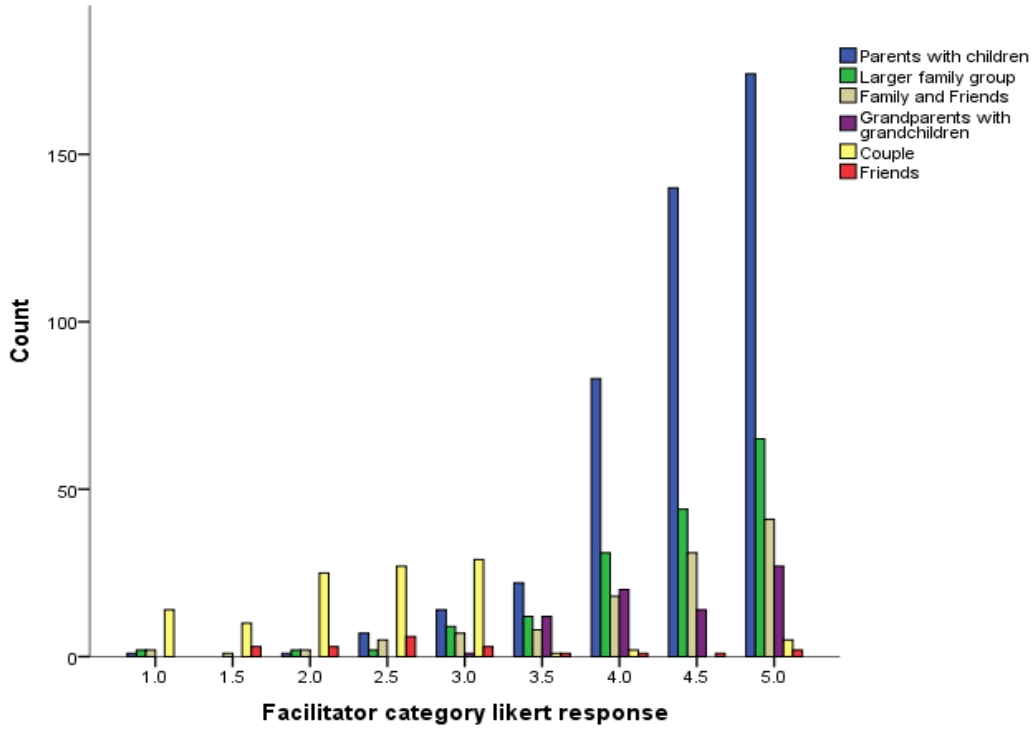


Figure 2-18. Relationship between group type and facilitator motivation

2.4 Discussion

2.4.1 Common routes followed and locations visited

Visitors were consistent in the park areas they visited with the most visited locations found along the perimeter path. As with Deans *et al*. (1987, as reported in Bitgood (2006)) and Davey (2006b) visitors tended to stay on what they perceived as the main path and less than half ventured into the centre of the park. Bitgood (2006) applied a general value principle model to visitor movements and suggested the inclination to stick to a main path, rather than deviate onto smaller paths, is an aspect of inertia and cost / benefit analysis. The uncertain benefits of venturing off the main path, to a destination that may not be visible, do not compensate for the additional cost of walking farther. In the absence of an incentive to deviate, the visitor will continue on the same path in the same direction. The conspecific attraction effect, where people tend to go where they can see other people have gone before them, also results in the majority following a single route.

The tendency for the majority of guests to follow the same route around the park resulted in a bunching effect with the majority of visitors arriving at key exhibits in relatively narrow time windows rather than being spread out across the day. Figure 2-6 and Figure 2-7 show that the majority of visitors at the Giraffe and lemur areas visit these popular locations within a small time window. This bunching and peaking in visitor numbers can be of benefit to the institution as it allows visitor presentations to be timed to coincide with the peak in visitor numbers at a given location, for example the giraffe talk is at 11:30am, and thus reach the largest number of visitors possible. Conversely, however, there is also a risk that these areas become overcrowded, stressing more sensitive animals and discouraging some visitors from stopping. This study did not examine visitor behaviour directly at these locations during peak times but this would be a worthwhile exercise in order to gauge the affects of these peaks in visitor flows.

The catering team at Marwell were aware of this common route affect to some extent and have been able to utilise this information in the positioning of outlets. A burger outlet near the Giraffe house was closed in 2014 as visitors were arriving at it too early in their day and it did not do enough business to justify retaining this option. The large indoor cafe conversely, which visitors encounter after about 2 hours at the zoo, was frequently overcrowded on busy days. A seasonal takeaway burger outlet was therefore opened adjacent to the cafe which did considerably better business than the outlet near the Giraffe house had done and relieved pressure on the indoor cafe.

The low level of visitors seen at locations such as the Meerkats or the Okapi, which were only visited by 47% and 27% of participants respectively, confirms the institution's concern that the central areas of the park were underutilised. Meerkats could reasonably be expected to be popular due to their entertaining nature and high media profile in the UK (BISL Limited 2014), but their position off the main path appears to result in their being missed by over half of visitors. The dwell time of those who did visit the Meerkat enclosure was above average (mean 3.82 minutes, SD 3.55) suggesting these visitors were rewarded for their efforts to explore more. The Okapi exhibit is much, larger consisting of two buildings and four paddocks, but was missed by nearly 75% of visitors. Those who did visit this location also stayed for above average dwell time (mean 3.54 minutes, SD 2.36) again suggesting these visitors were rewarded for their additional effort of seeking out this location.

It could have been hypothesised that visitors only have a certain capacity for viewing animals and, therefore, that those who took the time to find the less visited animals did

so at the expense of other exhibits. The results from this study, however, indicate that those visitors who spent time at these central locations did so in addition to the time spent at the main path animals most commonly visited by the majority of visitors. This suggests that action taken to allow more visitors to these exhibits would enhance their overall experience.

Dierking *et al.* (2004) found that animal activity levels did not influence dwell time when viewed at complex exhibits with many features to see and interact with. Conversely, where other activities are not available, the number and activity of the animals is a strong indicator of dwell time (Ridgway *et al.* 2005). The Okapi exhibit was an example of the former with a greater number and variation in interpretation items but the animals themselves are shy and elusive whereas the Meerkat enclosure, at the time of this study, was an example of the latter: a simple enclosure with animals that were almost always active and visible. This finding also conforms with that of Davey (2006a) who found visitors were willing to spend the time to look for animals at more complex exhibits and gained a level of satisfaction from the search. Since this study was conducted, the Meerkat enclosure has been relocated to a more prominent position on the perimeter path and work is underway to divert more visitors through the Okapi area on their way to a new exhibit. The new Meerkat enclosure is larger and split into two, landscaped areas with a variety of viewing and seating options. Anecdotally this has resulted in significantly larger numbers of visitors viewing these animals, although no formal visitor observations have been carried.

Visitors who were found not to have ventured to the animal enclosures in the interior of the park spent less time interacting with animals, less time in the park overall and covered a shorter distance. This reduced contact time gives the zoo less opportunity to engage with visitors and risks compromising the visitor experience (Fernandez *et al.* 2009; Santana-Jimenez and Hernandez 2011).

Dierking *et al.* (2004) also found that the animal locations with the longest dwell times were those with more than one viewing location or with a path to follow within the exhibit with a variety of things to see along the way. In this study, the Penguin and Tiger exhibits are examples of the former while the Tropical house and World of Lemurs are examples of the latter and all are among those with the longest dwell times. Tropical house and World of Lemurs, however, were only visited by just over half of all visitors (Table 2-3). These are both examples of larger, immersive exhibits which represent considerable investments in space, energy and manpower on the part of the zoo and which should offer many opportunities to engage with visitors. There are a

number of possible reasons for the low visitor numbers to these areas within the context of the zoo. They are generally encountered towards the end of the day when visitors may be getting tired and less inclined to look (Falk *et al.* 1985); the entrance to the tropical house in particular tends to be congested which may discourage people from entering (Ridgway *et al.* 2005; Fernandez *et al.* 2009); and the World of Lemurs entrance is somewhat hidden, meaning it is not obvious how much there is to see from the main path and hence what there is to gain from the additional effort of diverting from the main path (Bitgood *et al.* 2006). As with the Meerkat and Okapi exhibits, more work is needed in these locations to highlight the opportunities on offer to the visitors at these indoor exhibits.

2.4.2 Variation in visitor type affects dwell time at specific locations

Group type, distance travelled and visit frequency were found to have a large effect on how much time visitors spent within the park and at specific locations. Groups with children spent less time attending to the animals and more time at non-animal locations than those without. The greater input children had in deciding where these groups dwelt longest may reflect the differing expectations and limitations in attention span of children and adults (Bitgood 2002; Ridgway *et al.* 2005; Ross and Lukas 2005). The difference in time spent at non-animal locations also supports the findings of other authors who have found that visitors see zoos as social destinations as much as, or more than, places of learning (Clayton *et al.* 2009) and that social interaction can have a significant effect on dwell time at exhibits (Ridgway *et al.* 2005). The large family and family and friends groups spent the longest time in the park. These group types may see each other less often than immediate family so the social aspect of their visit will play a larger part in how they spend their day (Garrett 2013). While they may have come with the intention of engaging their children with nature and animals, they will also have other requirements for an enjoyable day out such as play and refreshment. Although the lowest income groups did not spend any longer in the park overall than other groups they did spend longer attending to the animals which agrees with Cooper (1981) that these groups make the most of their less frequent visits.

Participants did not readily split into the categorizations used by Falk (2006) and this was reflected in the minimal differences found in behaviour between groups moving around the park. As with Dawson and Jensen (2011) motivations were closely linked to group type with type of group having a larger effect on where they went and how much time they spent than the motivational categories.

Variations with the level of identification with each motivation were more significant than the variation between motivations and in particular the effect of children was again seen with those who identified more strongly as facilitators spending more time at the augmented product locations than the groups who identified less with this categorisation. The majority of those identifying with the facilitator motivation were parents and as such showed similar behaviours, spending less time at animals and more time at catering outlets and playgrounds. This supports the findings of other authors who have found that visitors see zoos as social destination, as much as, or more than, places of learning (Clayton *et al.* 2009) and that social interaction can have a significant effect on dwell time at exhibits (Ridgway *et al.* 2005). Whilst they may have come with the intention of engaging their children with nature and animals, they will also have other requirements for an enjoyable day out such as play and refreshment.

2.5 Conclusion

The aim of this chapter was to determine if GPS units could be used to accurately track visitors at an individual tourist attraction, to examine the spatial and temporal behaviour of those visitors within the environs of that attraction, and to investigate what demographic or group factors affected that behaviour. Understanding how visitors move around large attractions and what influences the choice of route can make a significant contribution to spatial planning for many institutions.

The GPS tool was effective at determining where visitors went and combining this data with the survey data was partially successful in differentiating between the behaviours of different group types. The tracking exercise was able to resolve visitor movements spatially across the park and temporally throughout the day. The technique was also able to distinguish behaviours of broad visitor groups such as those with and without children or those who visited frequently and first time visitors. The reluctance of visitors to stray from what they perceive to be the main path suggests more than simple way marking is needed to encourage visitors to explore locations away from the main exhibits. A country house and garden, for example, may need to do more than use signage to encourage visitors to walk to a distant lake and boathouse exhibit if it is out of sight of the main house, despite its potential aesthetic or historic interest. In the case examined here, simply signposting the World of Lemurs or Okapi exhibits may not be enough to persuade visitors to visit these locations. Inviting entrances with bold images

and themes may be necessary to highlight the rewards on offer for diverting into these exhibits.

To use visitor tracking most effectively as an evaluation tool it would help to know not only which locations were visited, but also which elements were popular within those locations. For example, the dwell time at various animal enclosures at Marwell Zoo showed a large amount of variation between groups. This may have been due to local factors such as activity level of the animals; poor vantage points for small children or to group factors such as low attention span of smaller children or grandparents wanting a rest. If attractions wish groups to spend more time at key locations like these, they will need to consider how they cater for the differing group types and their individual needs. More seating or more interactive elements might persuade different groups to dwell longer and experience more.

The boosted regression trees model used here had only moderate predictive power suggesting factors not tested here are also having an effect. Many variables can affect dwell time that it was not possible to include in this study but which could be investigated in future work. More detailed discussion with participants may reveal personal animal preferences or external factors affecting dwell time while observations around the zoo could highlight location specific issues of crowding, animal activity or spontaneous keeper interactions.

The resolution of the GPS units was not always high enough to distinguish between viewpoints and provides no insight into the reasons for choosing one location over another. For the larger exhibits at the case study location, some distinction was possible, for example between the front of penguin pool and rear lookout station. Elsewhere it would be difficult to say with any certainty whether the visitor was looking at one enclosure or the adjacent one. For example, was a participant on the back lawn looking at the monkeys or just picnicking in that area? Direct observation of visitors would be needed to resolve these more detailed issues. Using the methods described here it would not be possible to evaluate the effectiveness of an exhibit by separating which specific elements of an exhibit an individual is looking at such as Francis *et al.* (2007) did. This current limitation in accuracy suggests that GPS tracking is useful as a location-wide planning tool but that alternative, more precise methods are needed for exhibit design evaluations.

Combining GPS tracking with other methods may, however, improve the level of detail in key locations to allow exhibit evaluation. O'Connor *et al.* (2005) used small tracking tags of the type used for tracking and timing runners in large public races. These do not

record location continuously but instead they use radio frequency identification tags (RFID) technology to communicate with receivers placed in key locations to record time of arrival at that point. While less detailed overall, the short range of the receivers means this method has the advantage of being very precise to a specific location. This technology could work well in the zoo environment where receivers could be placed at the entrance and exit to exhibits, particularly indoor exhibits where GPS reception is poor, to accurately record arrival and departure times. Alternatively, Chrysanthis *et al.* (2012) combined GPS tracking with photographs taken by participants as they toured an archaeological site. This was able to give a good idea of what interested the participants in their small study (36 GPS tracks, 644 images) but could quickly become unwieldy in a larger study of the kind attempted here.

Providing accurate position information indoors is developing rapidly for large indoor retail outlets using high level cameras and smart phones (Clifford and Hardy 2013). Costs of CCTV cameras continue to fall and many attractions provide public Wi-Fi in large parts of their parks so these methods of tracking have the potential to allow a far greater range of tracking studies to be undertaken. Combinations of park-wide GPS tracking and more detailed methods at locations of specific interest may therefore benefit from the advantages of both types of data gathering and compensate for the limitations of each. GPS receivers are now common in mobile devices hence many attractions now provide navigation and information apps which couple location data with pop-up information triggered by Wi-Fi or Bluetooth 'ibeacons'. These apps provide the opportunity to gather much greater detail on a visitor’s movement and interaction but privacy concerns will need to be addressed before detailed visitor tracking becomes widespread to avoid risking alienating visitors.

This study combined an entrance survey to categorise visitors with GPS tracking to examine the behaviour of those visitors. Using one or more of the methods described above to improve the positional accuracy of the tracking and combining this with an exit survey could provide valuable insight into the effectiveness of exhibit design in delivering learning opportunities or providing an entertaining and enjoyable day out.

Encouraging visitors to explore fully and maximise their time at an attraction maximises both their learning opportunity and their chances of satiation from their day out. Whether their visit was for learning, or for an opportunity to spend time together as a family or group of friends, providing a full day out will maximise the visitors opportunity to achieve those objectives, providing they are kept entertained and engaged throughout.

The GPS tracking exercise indicates that many visitors, and particularly repeat visitors, to zoos spend significant portions of their day moving and engaging in non-animal related activity rather than engaging with the animals. Less frequent and first time visitors are prepared to spend longer engaging with animals and hence may have a different learning experience to the frequent visitor. Future development should provide more opportunities to slow down, stop and look at 'experience points' in order to engage a greater proportion of visitors. It is at these locations where learning is most likely to happen (Serrell 1998; Davey *et al.* 2005) and a visit can be enhanced by greater interaction with animals and the exhibits (Gutwill and Allen 2010). Conversely, for those frequent visitors who prefer a shorter visit, 'quick facts' that are easily read and understood and can potentially be changed regularly may help to keep these visitors engaged and develop their understanding and awareness over a number of visits. The relationship between visitor movement and learning opportunities is explored in chapter 3.

Chapter 3: Visitor recall of locations visited, messages received and intention to act

Abstract

The modern zoo aims to be a place of learning where visitors can learn about, and connect with, animals and nature. Evaluating the effectiveness of learning at education type attractions is much discussed and evidence of learning taking place is variable. In zoos, the presence of animals has been shown to be effective at engaging people and therefore an opportunity exists to facilitate exploration and learning in visitors and provide a stimulus to changing behaviour. Identifying where people learn within an attraction, and what types of visitor or groups of visitors learn the most, can help planners to determine where facilities and interpretation need improving and how new exhibits can be best designed to allow for discourse and learning. Using positioning data from a recent GPS tracking survey, this study attempted to link what visitors to a large UK zoo learnt, which sources they learnt from and whether there was a link between dwell time at exhibits and total in the zoo and learning or intention to change behaviour. Visitors were found to have relatively poor recall of where they went within the zoo. Two thirds of visitors believed they had learnt from their visit and those visitors who learn most had spent longer in the zoo and covered a longer distance than those who had not learnt during their visit. Those visitors who stated an intention to change behaviour as a result of their visit spent longer looking at animals, longer at the zoo overall and covered a longer distance.

3.1 Introduction

The previous chapter demonstrated the effectiveness of using small GPS units to unobtrusively track the movement of visitors around a large attraction. Combining the GPS data with demographic data was also shown to be partly successful in determining differences in behaviour between different groups of people.

In this chapter the same GPS data is combined with further survey data from an exit survey completed by the participants as part of the same evaluation exercise. The exit survey used more open questions to examine visitors recall of the locations they visited, whether they remembered any learning elements from their visit and whether they felt inspired to change any aspect of their behaviour to protect wildlife following the visit. The GPS survey combination allows for comparison between locations visited and learning and intention to change behaviour.

Whilst historically zoos may have been primarily places of entertainment, today many zoos are either actively involved in field conservation projects or provide financial support to third party conservation programmes. Within the zoo environment conservation activity is supported by formal and informal educational activities aimed at raising awareness and inspiring the visiting public (EAZA 2004; WAZA 2005; AZA 2014). With over 22 million people visiting a UK zoo or aquarium each year (Hansen *et al.* 2013) there is certainly an opportunity to reach a large audience but there is a need to demonstrate that aspirations to affect a change to sustainable living are being realised (BIAZA 2011b).

Many modern zoos in Europe, North America and Australia now include education and inspiring change in their mission statements (Miller *et al.* 2004; Patrick *et al.* 2007) but few have sufficient evidence to show progress against these good intentions. Demonstrating that learning takes place or that changes in visitor behaviour result from a zoo visit has proved difficult (Tunnicliffe *et al.* 1997; Smith *et al.* 2012a). A correlation between level of environmental knowledge and pro-environmental behaviour has been found (Coyle 2005) but a causal link is far from clear. Knowledge is necessary for the adoption of pro-environmental behaviour, but is not sufficient to bring about a change in behaviour alone (Kollmus and Agyeman, 2002). A person needs knowledge of both the problem and the solution in order to take action (Bamberg and Moser 2007) and zoos and aquaria may have a role in providing the required knowledge or reinforcing knowledge gained elsewhere (Falk *et al.* 2007; Falk and Dierking 2010).

Various researchers have looked at learning from visits to zoos and museums (McManus 1989; Scott 2006; Ballantyne *et al.* 2007; Falk *et al.* 2007; Marino *et al.* 2010) and how the visitors interact with the information provided. The inclusion of animals creates an immediate hook to engage the visitor (Serrell 1998) and can add a level of excitement and entertainment that stimulates the visitor to explore further (Woods 1998). Visitors, however, have a limited amount of attention to spend during their day (Falk *et al.* 1985; Serrell 1998; Francis *et al.* 2007) which is spread over the various exhibits they encounter and may diminish towards the end of their day as a result of saturation of information. Bitgood (2009) noted that while this drop off in attention is often referred to as 'fatigue' it has little to do with either physical or mental tiredness but more to do with boredom and familiarity. Repetition may be effective at communicating key messages but too many repeats will disengage the visitor (Smith *et al.* 2012b). The visitor may start to feel they have seen all an exhibit has to offer and move on to the next regardless of whether they have actuality explored any significant part of it (Bitgood 2009). The visitor's attention and engagement can be refreshed by changing the way in which information is presented, keeping it easily accessible and engaging (Miglietta *et al.* 2011) and making sure any learning is fun with the animals as the focus not distracting from them (Moss and Esson 2010). Attention can also be refreshed by changing the type of experience with variety of environment and surroundings or by creating 'break zones' for play, restoration (food and drink) or relaxation (Ridgway *et al.* 2005). Where the visitor goes within the zoo and the route they take, therefore, is an important consideration in maximising their enjoyment, relaxation and learning opportunities. Too high a density of similar exhibits may leave them overwhelmed and 'fatigued' while too low a density could leave an unsatisfactory feeling of not having seen or done enough. The zoo visitor is expecting an enjoyable day out (Morgan and Hodgkinson 1999) but there are various other motivations to do with learning and exploration also at play (Falk 2006) and these expectations need to be met through the variety of experiences on offer.

To be effective in inspiring visitors to take action against global issues such as climate change or habitat destruction, a zoo not only needs the visitor to acquire new knowledge, but also to inspire the visitor to take action using the newly acquired understanding. Visitors' intentions to change their behaviour have been identified in a percentage of zoo visitors (Falk *et al.* 2007; Smith *et al.* 2008) but in follow up interviews only a small number had actually started the intended behaviour (Smith *et al.* 2008) reflecting the value action-gap commonly found between sympathetic attitude to environmental issues and affirmative action to moderate environmentally damaging

behaviour (Barr 2006; Newton and Meyer 2013). Adelman *et al.* (2000) found that visitors to the National Aquarium in Baltimore did retain information learned during a visit for a period of weeks after the visit, but that intentions to change aspects of their behaviour in favour of conservation were not followed through. The authors suggest this may be due to the absence of any reinforcing messages after the visit, confirming the supposition that zoos and aquaria can be a catalyst for change in behaviour or reinforce messages heard elsewhere but that additional influences (e.g. behaviour has also been adopted by members of social circle or the behaviour is incentivised financially) are needed to affect genuine behaviour change (Barr and Gilg 2006).

In order to engage visitors in sustainable behaviours they need to be able to identify with the behaviour on a personal level (Ajzen 1991; Skår *et al.* 2008; Ajzen *et al.* 2009). For zoos, the presence of exotic and endangered animals and plants should provide ample opportunity to engage with the visitor and start to make these personal and emotional connections (Kellert *et al.* 1996; Moss and Esson 2010; Luebke *et al.* 2012). It is also possible that a few individuals could be inspired to make big changes and embark on a career that makes a significant change. Chawla (1999) found that the majority of environmental professionals in their study reported exposure to the natural world as a major factor in their choosing environmental activism as a career path. Reinforcing and confirming connections made with natural environments or introducing new habitats or experiences out of the reach of many people may contribute to the uptake of sustainable behaviours. A single visit may not be sufficient to inspire change on its own, but continued exposure over time may lead to adoption of new ideas and behaviours (Everett and Barrett 2009) hence developing a long term relationship with visitors over many repeat visits may be necessary to encourage take up of more sustainable behaviours.

Bitgood *et al.* (2006) used the general value model to show that visitors to an exhibit use a simple cost benefit analysis to determine how much time and attention to devote to an exhibit. If the costs were high (queues, crowding, difficult text, obstructed views) and the benefit was low (unexciting exhibit, poorly presented information, animals not visible) then attention is low and the visitor quickly leaves the exhibit area in search of other experiences. Dwell time is, therefore, a useful indictor of engagement with an exhibit and is a widely accepted method of evaluating visitor experience (Francis *et al.* 2007). A positive correlation has been demonstrated between learning and dwell time (Balling and Falk 1980; Raphling and Serrell 1993; Borun *et al.* 1996). Maintaining attention and increasing dwell time, therefore, is vital to the delivery of key messages in

zoos and hence being able to measure dwell time accurately is important for evaluating success

Studies of visitor movements tend to focus on movement and behaviour around specific exhibits, usually new ones (Marcellini and Jenssen 1988; Ridgway *et al.* 2005; Francis *et al.* 2007) and use either direct observation or post visit recall by participants. Various studies, however, have questioned the accuracy of visitor recall of movements and of travel / map diaries (Hallo *et al.* 2004; Stedman *et al.* 2004; Hallo *et al.* 2012) with participants tending to over represent key locations, while ignoring other stops, and overestimating distance travelled. On the other hand remote tracking of visitors over the whole of larger attractions using GPS equipment has been evaluated in studies in locations such as national parks and has been found to be both accurate and unobtrusive (Shoval and Isaacson 2007). Studies comparing GPS methods with more traditional visitor diary and recall mapping exercises found the former to be more accurate and less prone to unconscious or conscious bias (Bitgood and Richardson 1986; Stedman *et al.* 2004; Hallo *et al.* 2012). In particular Bitgood and Richardson (1986) found visitors consistently overestimated total time spent in a zoo and were only about 60% accurate at recalling the route taken and locations visited. GPS techniques therefore have the potential to gather detailed information on where the visitors went without relying on visitor recall of their time.

This study examines the relationship between dwell time throughout a zoological park, as acquired through a GPS tracking exercise, and visitor learning, awareness of the conservation activity of the zoo, and how this might be translated into taking action in the visitor's own life to minimise biodiversity loss. The study aims to determine how well visitors remember their visit at the end of the day, whether learning is occurring at particular locations or at learning events and whether visitors feel any intention to change behaviour as a result of their visit.

3.2 Method

Participants of the GPS tracking survey reported in chapter 2 were asked to complete a further survey (Appendix 3:1) as they left the park. The survey asked where they thought they had spent the most amount of time within the park, whether they felt they had learnt from the visit to Marwell and whether they thought they would make any changes to their lifestyle as a result of their visit. The surveys were conducted with one member from each group of visitors, with the same group member completing both before and after surveys.

3.3 Analysis

Rather than risk prompting and introducing bias the exit survey consisted of a series of open questions (Schuman and Presser 1979). The questions covered which locations the participants visited, their experiences of learning, awareness of Marwell as a conservation charity and their intention to change behaviour away from the park. Some questions required a specific answer, e.g. 'which animal did you spend longest at?' while others were entirely open ended e.g. 'why did you spend longest at this location?' In order to analyse answers to these open ended questions it was necessary to group the answers received into a smaller number of answer categories.

For questions regarding what had been learnt, some participants were able to give one or more examples of things they had learnt while others remembered what they had been learning about but could not recall specific details. Answers were therefore ranked from 0 – 3 according to Table 3-1.

Table 3-1. Ranking of visitor learning

Rank	Definition
0	Did not think they had learnt anything
1	Thought they had learnt but could not remember any details
2	Thought they had learnt and described animal or topic they had learnt about
3	Were able to give specific details of something they had learnt

The times spent attending to animals (chapter 2 & Yalowitz and Bronnenkant 2009) as recorded by the GPS units, were ranked from longest to shortest time to allow comparison with where the participants thought they spent the longest time. The times were rounded to the nearest minute before ranking to create equal ranks for dwell times that differed by only a few seconds. The measure of time spent 'attending to' or dwelling at animals and other locations was also used to compare what types of location participants spent most time in.

3.4 Results

3.4.1 Visitor recall of locations visited

The longest dwell time for individual visitors was at only a few animal locations with 62.1% spending longest at one of three locations: Penguin, Tigers or World of Lemurs (Table 3-2).

Table 3-2. Locations where visitors dwelt longest (n = 932)

Animal location	Number of visitors who spent longest at this location	Percentage of total visitors	Mean dwell time of visitors who spent longest at location (minutes)	SD
Penguin	265	28.4%	15.5	8.4
Tigers	158	17.0%	21.7	14.2
World of Lemurs	156	16.7%	15.6	9.0
Tropical House	70	7.5%	11.5	5.0
Valley Field	48	5.2%	29.0	17.3
Giraffe	35	4.0%	15.5	10.2
Otter & Gibbon	30	3.2%	16.4	8.9
Reptile barn	27	2.9%	13.8	5.8
Heart of Africa	21	2.3%	10.9	9.5
Cheetah	20	2.1%	13.9	10.3
Amur Leopard	16	1.7%	11.4	7.7
Wallaby walk	13	1.4%	18.1	14.2

Visitors were found not to be very good at identifying the animal location they spent the longest amount of time at (Table 3-3). Overall only 30.8% of visitors correctly named the animal that they spent the most amount of time at (Figure 3-1). The majority (74.8%) of the animals named were ranked in the top five animal locations that they had spent the longest at indicating they were somewhat aware of their locations with the longest dwell (Figure 3-1).

Table 3-3. Where visitors thought they spent most time vs where they actually spent most time

Animal location	Number of visitors who thought this was longest location	Number of these visitors who actually spent longest here	Percentage
Giraffe	201	24	12%
Tigers	145	67	46%
Penguin	114	65	45%
World of Lemurs	61	33	54%
Meerkat	49	3	6%
No one animal	49	-	
Snow Leopard	34	3	9%
Rhino	32	4	13%
Cheetah	26	3	12%
Amur Leopard	20	6	30%
Pigmy Hippo	20	3	15%
Anteater	18	0	0%
Okapi	18	1	6%
Otter & Gibbon	17	0	0%
Valley field	12	1	8%
Tropical House	11	3	27%
Red Panda	10	0	0%
Macaque	10	0	0%

Visitors were better at naming the location where they spent most time overall (Table 3-4) with 45.5% of visitors correctly naming the location they spent longest at (Figure 3-2). In this case 83.3% of the named locations were ranked in the top five locations visited.

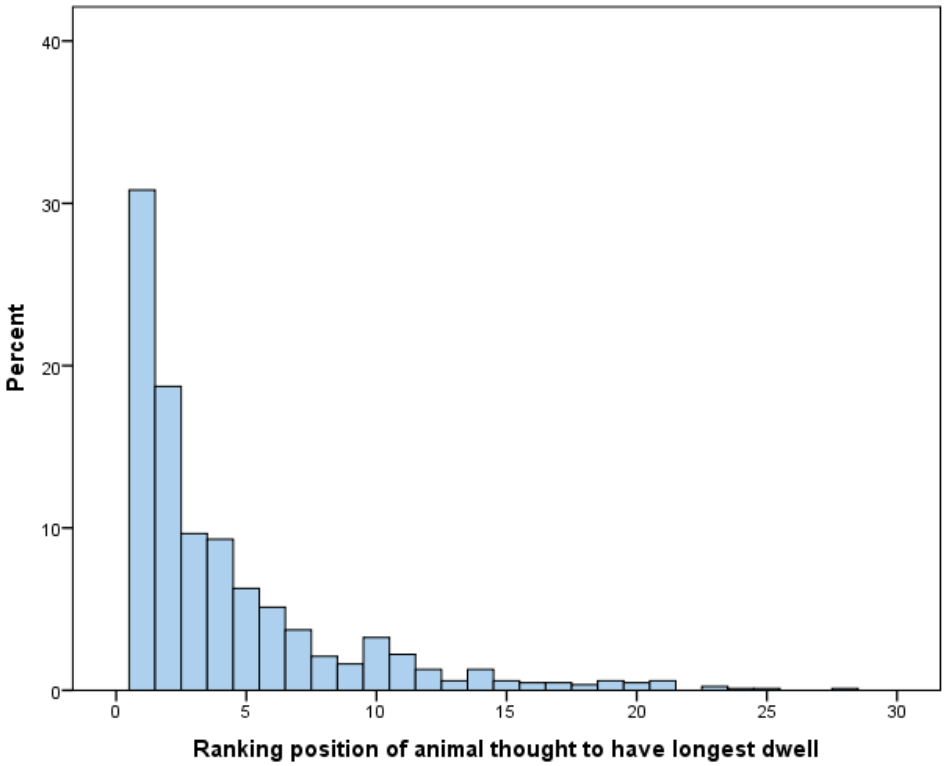


Figure 3-1. Actual position in ranking of the animal location where visitors thought they dwelt longest. Median 3, Mean 4.29, SD 4.39

Table 3-4. Location where visitors thought they spent longest overall

Overall location	Number of visitors who thought this was longest location overall	Number of these visitors who actually spent longest here	Percentage correct
Playgrounds	170	102	60%
Cafe Graze	91	70	77%
Into Africa / Heart of Africa	90	14	16%
Tigers	73	32	44%
Encounter Village	41	26	63%
Giraffe	37	7	19%
Lemur	35	6	17%
Tropical House	20	1	5%
Penguin	16	5	31%
Marwell Hall	14	11	79%
African BBQ	11	8	72%
Big Cats	10	3	30%

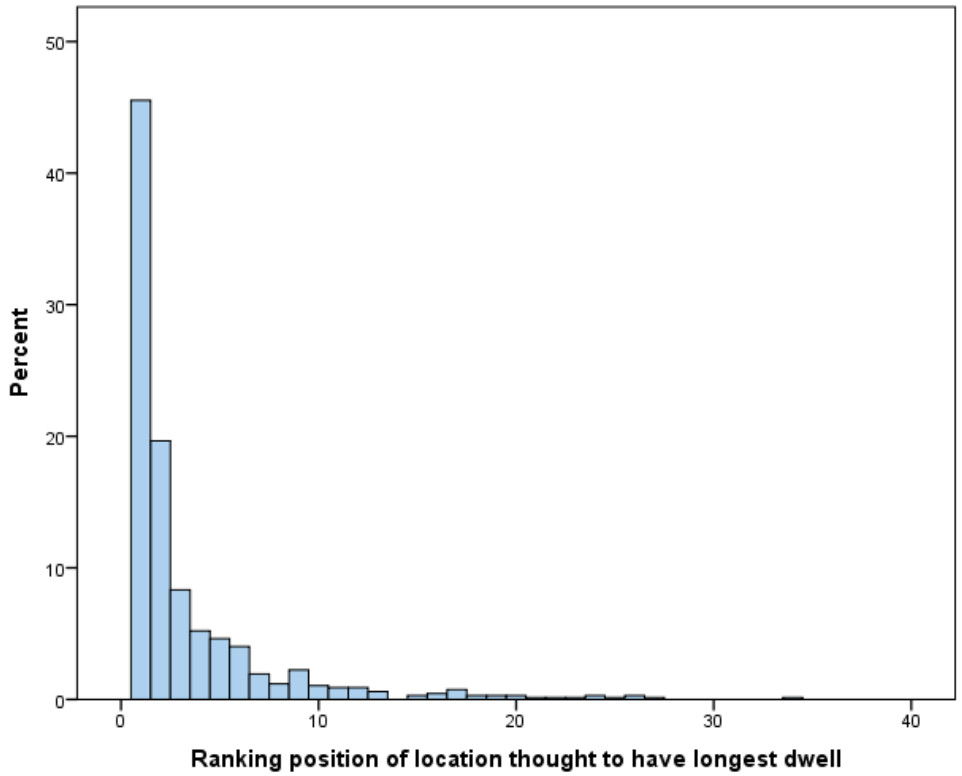


Figure 3-2. Actual position in ranking of the location visitors thought they dwelt longest at overall. Median 2, Mean 3.38, SD 4.33

When asked to name a favourite animal, participants who named a favourite animal that is present at Marwell are more likely to name this animal as the one they spent most time at the end of the day, regardless of where they actually spent the most amount of time (Table 3-5). This is consistent with the most common reason for spending longest at an animal as it being one they like or a favourite (Table 3-6).

Penguins were unusual for being under reported with fewer of the visitors who listed penguin as their favourite animal giving this location as their longest dwell than was actually the case (Table 3-5).

Of those who list favourite animals as the location where they dwelt longest, those listing giraffe and meerkats showed a large discrepancy between the number of participants who think they spent longest at either of these compared to the actual number who did spend longest at these locations (Table 3-5).

Table 3-5. No of times favourite animals are cited as those with longest dwell time

Animal	Number of mentions as favourite animal	Number who think this was longest dwell	%	Actual number who dwelt longest at this location	%
Tiger	259	68	26.3%	54	20.8%
Giraffe	257	97	37.7%	17	6.6%
Penguin	200	47	23.5%	64	32.0%
Monkey	121	12	9.9%	4	3.3%
Elephant	121	-[7]	-	-	-
Lions	100	-[7]	-	-	-
Meerkat	92	20	21.7%	2	2.2%
None	78	-[7]	-	-	-
Big cats	72	23	31.9%	20	27.8%
Snow leopard	38	5	13.2%	2	5.3%
All	35	-[7]	-	-	-
Cheetah	27	1	3.7%	3	11.1%
Hippo	26	1	3.8%	0	0%
Horses	23	0	0%	0	0%
Zebra	22	3	13.6%	0	0%
Dolphin	22	-[7]	-	-	-
Leopard	20	3	15.0%	2	10.0%
Lemur	17	3	17.6%	5	29.4%
Dogs	12	-[7]	-	-	-
Wolf	12	-[7]	-	-	-
Anteater	12	1	8.3%	0	0%
Bats	11	0	0%	0	0%
Snake	11	1	9.1%	0	0%
Red Panda	11	1	9.1%	0	0%
Pigs	11	-[7]	-	-	-
Birds of prey	10	-[7]	-	-	-

Two reasons why participants said they stayed longer at particular locations were more common than all the others: ‘like / favourite’; and ‘active / entertaining / something going on’ (Table 3-6).

[7] These animals were listed as favourites but are not present at Marwell Wildlife.

Table 3-6. Reasons given for staying longest at stated location

	Frequency	Percent
Like / favourite	289	31.0%
Active / entertaining / something going on	151	16.2%
No particular reason	74	7.9%
Easy to see / lots to see	70	7.5%
Wonder / Awe	65	7.0%
There was a baby animal	62	6.7%
Interesting / interactive	43	4.6%
Cute	33	3.5%
New / unusual	30	3.2%
Trying to find	23	2.5%
Inside / sheltering	21	2.3%
Food / ice cream / coffee break	20	2.1%
Nice location / interesting enclosure	19	2.0%
Other	15	1.6%
Keeper or volunteer talk	10	1.1%
Trying to photograph	6	0.6%

In smaller family groups children within the group were influential in choosing which locations the group dwelt at for the longest (Figure 3-3). In the smaller groups the child made the decision around 40% of the time while in the larger groups with children it was around 22%.

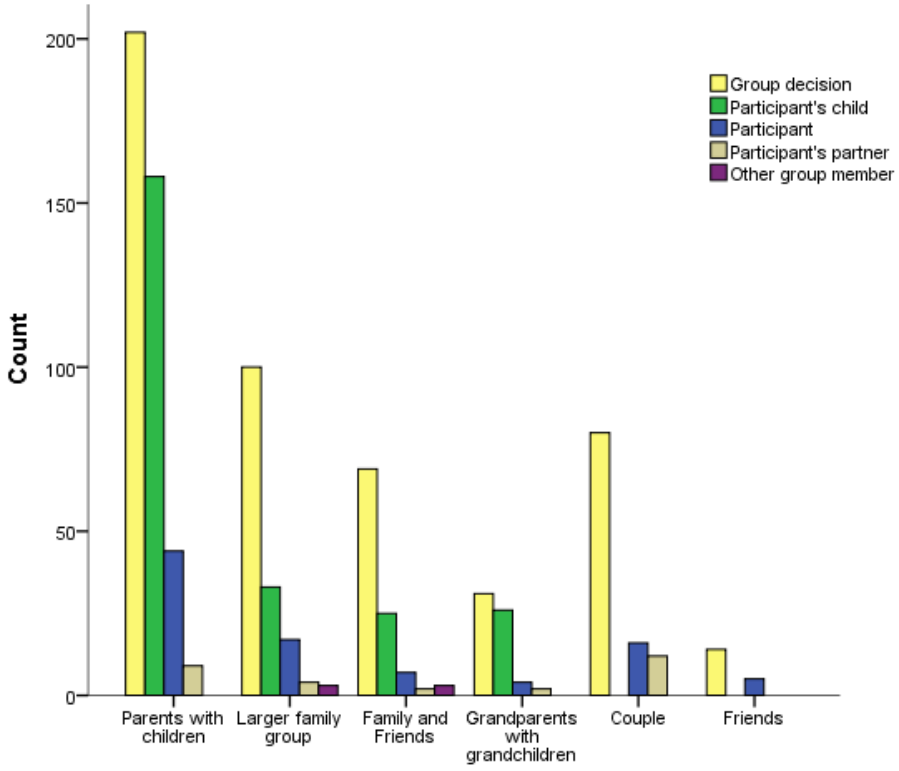


Figure 3-3. Variation in who made the decision to stay at the animal location thought to have the longest dwell time

3.4.2 Visitor learning

Over two thirds of participants (652, 70%) thought that learning about wildlife was an important or very important motivation for choosing the visit Marwell Zoo.

A quarter of participants (231, 24.7%) went to at least one of the public engagement events such as 'meet the keeper' or ‘tarantula talk’ during their visit (Table 3-7). A little over half of those attending events (57.6%) felt they had learnt from the event, although only around a third could remember specific details at the end of the day (Table 3-8). The tarantula talk was the most commonly attended event and showed the largest number of remembered details followed by penguins (Table 3-9).

Table 3-7. Public engagement events most frequently attended

Event	Number of participants	Percentage of total participants, n=931
Tarantula talk	64	7%
Penguin feed	31	3%
Giraffe feed	26	3%
Meerkat feed	16	2%
Gibbon feed	13	1%
Rhino meet the keeper	12	1%
Cockroach encounter	10	1%

Table 3-8. Number of participants reporting learning from engagement events

Learning from events response	Number of participants	Percentage	Rank (Table 3-1)
Attended an event but did not feel they had learnt	98	42.4%	0
Felt they had learnt but could not remember details	14	6.1%	1
Felt they had learnt and could remember the topic or animal	44	19.0%	2
Felt they had learnt and gave at least one example	75	32.5%	3

Table 3-9. Specific details most often remembered from engagement events

Detail from engagement events recalled at end of day	No of mentions
Tarantula life span	8
Tarantula hairs are itchy and can be shot out in defence	6
Hissing cockroach have a variety of hisses	5
Tarantula have 8 eyes, some looking backwards	5
Meerkat diet	5
Tarantula only bite for defence	5
Penguins look different because some are moulting	4
Penguin diet	4
Tarantula bite is mild, feels like a bee sting	4
Tarantula are venomous not poisonous	3
Penguin feed chicks by regurgitation	2
Why Ralph is wearing a wetsuit[8]	2
Tarantula lay 200 eggs at a time	2
Rhino Horn grows continuously so rub it on things to grind down	2
Tarantula are from Chile	2

A much higher number of visitors (622, 66.7%) felt they had learnt from sources other than the engagement events. Of those (413, 44.3%) were able to articulate some detail about at least one example of what they had learnt (Table 3-10 & Table 3-11).

Table 3-10. Numbers of participants learning from sources other than engagement events

Learning from other sources response	Number of participants	Percentage	Rank (Table 3-1)
Did not feel they had learnt from other sources	310	33.2%	0
Felt they had learnt but could not remember details	130	13.8%	1
Felt they had learnt and could remember the topic or animal	82	8.8%	2
Felt they had learnt and gave at least one example	413	44.2%	3

[8] Ralph is a penguin with an atypical moult leaving bald patches. He wears a wetsuit to keep warm and protect his skin from the sun during his moults. https://www.marwell.org.uk/zoo/news/47/suits-you-ralph

Table 3-11. Most remembered information from sources other than engagement events

Detail recalled at end of day	No of mentions
Baby kangaroo are size of a baked bean when born	26
Okapi can clean whole body with tongue including ears and eyes	15
Fossa – never heard of it, seeing for the first time[9]	14
Lemurs are only from Madagascar	13
Flamingo are pink because of their diet	9
Coati can turn ankles through 180^0 to climb down trees	8
Penguins have barbed tongue to hold fish	7
50% of four species of Partula snail live at Marwell	5
Pygmy hippo secrete a natural sunscreen	4
Fossa predate on lemurs in the wild	3

Physical characteristics such as stripe patterns were most commonly remembered from the engagement events (Table 3-12) whereas species details such as country of origin were more commonly remembered from the participants own exploration (Table 3-12).

Despite the low dwell time, information about the kangaroo, and particularly the detail about the size of the young at birth, stuck in the minds of participants. Information about the okapi was second most remembered detail despite being visited by only 27% of participants. Okapi was also the most frequently mentioned of all animals when talking about learning at the end of the day (Table 3-13).

[9] Two participants commented that they hadn't realised Fossa were real. They thought they had been made up for the animated film Madagascar

Table 3-12. Frequency with which topics were remembered by participants

Type of information remembered	Recalling information from talks		Recalling information from other sources	
	Number of participants	Percentage of responses	Number of participants	Percentage of responses
Physical characteristics e.g. length of tongue, stripe patterns, ability to rotate ankles	58	54.2%	79	16.8%
New animal not seen before	0	0%	79	16.8%
Species details - e.g. where from, number of different species	15	14.0%	175	37.0%
Care detail - e.g. pills for penguins, enclosure type, feeding ex situ	17	15.9%	11	2.3%
Endangered status	0	0%	38	8.0%
What not to buy	N/A[10]	N/A	25	5.3%
None specific comment e.g. “how long they live” or “what they eat”	17	15.9%	65	13.8%

[10] "What not to buy" was a specific exhibit that existed until 2012, the topic is not covered in engagement events

Table 3-13. Most mentioned animals remembered from sources other than engagement events

Animal	Number of times mentioned at end of day	Percentage of visitors visiting location	Mean "attending" dwell time of those visiting this location (minutes)	SD
Okapi	42	27%	3.5	2.36
Lemur	34	54%	11.1	7.22
Kangaroo	31	89%	1.0	1.19
Penguin	25	98%	9.8	6.93
Fossa	23	54%	11.1	7.22
Tiger	22	77%	9.3	10.14
Ants	20	60%	7.3	4.42
Snow Leopard	19	72%	3.3	2.94
Flamingo	17	[11]		
Giraffe	16	93%	4.2	4.21
Rhino	16	59%	1.9	2.62
Pygmy Hippo	14	82%	2.9	2.88
Zebra	14	[11]		
Anteater	14	90%	1.5	1.59
Ocelot	12	[11]		

Twenty (15.1%) of the 132 participants who felt they had learnt from engagement events did not feel they learnt from any other sources during their visit. Out of all participants 270 (29%) did not feel they had learnt from talks or any other sources during their visit.

Significant variation was found in total time spent looking at animals, total time spent in the park and distance covered between those who went to events and learnt, those who went and did not learn and those who did not attend events (Table 3-14). Post Hoc analysis (Tukey HSB) found the largest differences between those who felt they had learnt from the events and the other two groups.

Significant variation was also found in time spent looking at animals, time spent in the park and distance covered between those who felt they had learnt from sources other than events and those who felt they had not (Table 3-14).

[11] These animal locations could not be resolved on the GPS tracks so data on number of visits or dwell times is not available

Table 3-14. Variation in time and distance with learning

Participant description	N	Mean time at animals (minutes)	SD	Mean time in park (minutes)	SD	Mean distance covered (meters)	SD
Participants not attending engagement events	665	74.81	35.36	227.11	69.27	5438	1731
Participants who attended engagement events but did not feel they learnt	127	82.50	39.29	250.01	72.18	5408	1676
Participants who attended engagement events and thought they learnt	140	100.37	37.14	278.73	62.53	5978	1715
Significant difference (ANOVA)		$F_{(2,931)} = 29.287$ $p< 0.001$		$F_{(2,931)} = 34.882$ $p< 0.001$		$F_{(2,931)} = 5.973$ $p< 0.01$	
Participants who thought they had learnt from sources other than engagement events	632	84.83	35.80	246.89	68.56	5659	1670
Participants who did not think they had learnt from sources other than engagement events	300	68.83	35.80	219.23	73.00	5112	1818
Significant difference (ANOVA)		$F_{(1, 931)} = 39.151$ $p< 0.001$		$F_{(1, 931)} = 31.736$ $p< 0.001$		$F_{(1, 931)} = 13.812$ $p< 0.001$	

Table 3-15. Variation in attention time at location with learning from other sources

Location	Time at location				ANOVA	
	Learnt		Did not learn			
	Mean	SD	Mean	SD	$F_{(1,931)}$	P <
Penguin	10.34	7.33	8.54	5.87	13.436	0.001
Amur Leopard	4.34	3.14	3.61	3.09	10.555	0.01
Snow Leopard	3.34	2.94	3.13	2.95	7.137	0.01
Giraffe	4.42	4.42	3.63	3.69	6.595	0.05
Tropical House	7.51	4.48	6.54	4.03	5.550	0.05
Okapi	3.74	2.49	3.00	1.94	5.183	0.05
Kangaroo	1.11	1.24	0.91	1.09	5.115	0.05
World of Lemurs	11.32	7.37	10.42	6.86	1.627	NS

Significant variation was found in dwell time at certain animals for participants who reported having learnt from sources other than engagement events (Table 3-15). The difference in dwell time for the most commonly mentioned animals (okapi, lemur & kangaroo) was fairly small and in the case of the lemurs was not significant.

Some variation in learning from sources other than engagement events was found between different groups with those consisting of family and friends the most likely to report learning from these sources, and grandparents with grandchildren least likely ($F_{(5, 921)}$, = 5.031, $p < 0.001$, Figure 3-4). Some variation in learning from sources other than event was seen with the number of previous visits with those who visited least reporting higher levels of learning and regular visitors reporting lowest levels of learning ($F_{(5, 921)} = 4.472$, $p < 0.001$, Figure 3-5). Members in particular were less likely to have learnt during their visit than non-members ($F_{(1, 922)} = 15.534$, $p < 0.001$).

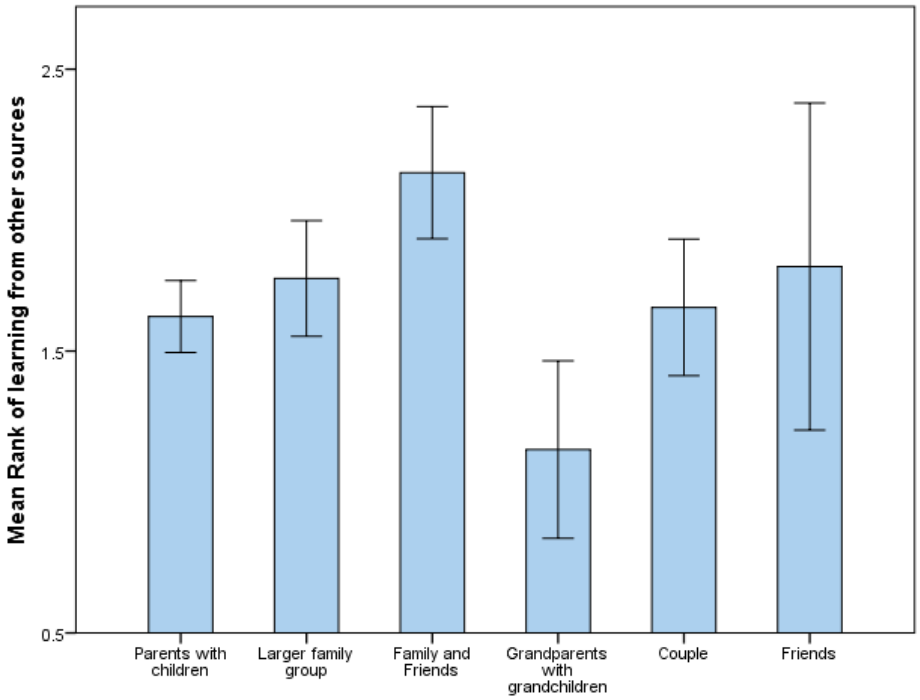


Figure 3-4. Variation in learning from sources other than events with group type. Error bars ± 95%CI, vertical axis truncated for added clarity

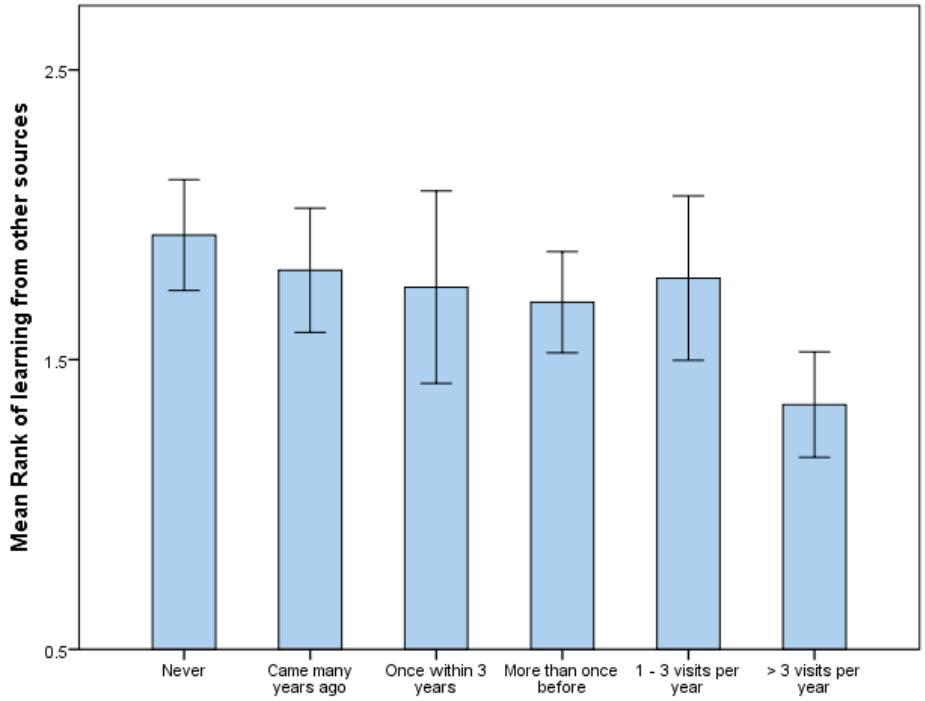


Figure 3-5. Variation in learning from sources other than events with frequency of previous visits. Error bars ± 95% CI, vertical axis truncated for added clarity

3.4.3 Awareness of conservation activity[12]

Out of all participants, 677 (72.7%) reported that they had been aware of Marwell's conservation activity prior to their visit, although the degree of knowledge varied considerably (Table 3-16). Of the remaining 254 participants, who had not been aware of Marwell's conservation work prior to their visit, 131 (55.7%) stated they had become aware to some degree as a result of their visit. Only 16 of these newly aware participants were able to give a specific example of an area of conservation in which Marwell was active.

A correlation was found between those who were aware of Marwell's conservation activities and the number of previous visits ($r=0.453$, $n=931$, $p<0.001$) with the most frequent visitors significantly more likely to be aware of the conservation activity than less frequent ($F(5, 929) = 50.132$, $p < 0.001$ Tukey HSD, Figure 3-6).

Participants who reported being aware of Marwell's conservation work prior to their visit spent more time in the park overall ($F_{(1, 930)} = 10.699$, $p < 0.01$) and covered more distance ($F_{(1, 930)} = 4.188$, $p < 0.05$). There was no significant difference in time spent looking at animals however, but these participants were found to have spent more time in non animal locations (e.g. playgrounds $F_{(1, 930)} = 10.005$, $p < 0.01$) than people who reported being unaware.

Being able to remember more details of Marwell's conservation activity did not correspond to significant difference in time spent at any individual location or to time spent in the park or distance covered overall (e.g. total time in park $F_{(3, 923)} = 1.282$, $p = 0.279$).

[12] Participants were asked if they had been aware of Marwell's conservation activity prior to their visit. Those who said they were aware were then asked to state what areas they could remember that Marwell was active in. Those who said they were unaware were asked if they had seen any information about it during their visit and, if so, what they could remember

Table 3-16. Common responses regarding Marwell conservation activities

Response	Number of responses from those aware of conservation prior to visit	Percentage	Number of responses from those only aware of conservation post visit	Percentage
Not able to provide examples	349	51.6%	115	87.8%
Breeding animals	73	10.7%	3	2.3%
Cheetah	49	7.2%	0	0%
Snow leopard	42	6.2%	1	0.8%
Work with endangered species	27	4.0%	0	0%
Przewalski's horse	18	2.7%	0	0%
Tiger	17	2.5%	1	0.8%
Work in Africa	15	2.2%	1	0.8%
Partula snails	15	2.3%	5	3.8%
Work in Zimbabwe	14	2.1%	2	1.5%
Giraffe	11	1.6%	1	0.8%
Flight[13]	11	1.6%	1	0.8%
Leopard	10	1.5%	0	0%
Birds	10	1.5%	1	0.8%
Okapi	10	1.5%	0	0%

[13] Flight was a specific campaign in 2010 to raise awareness of conservation issue around birds

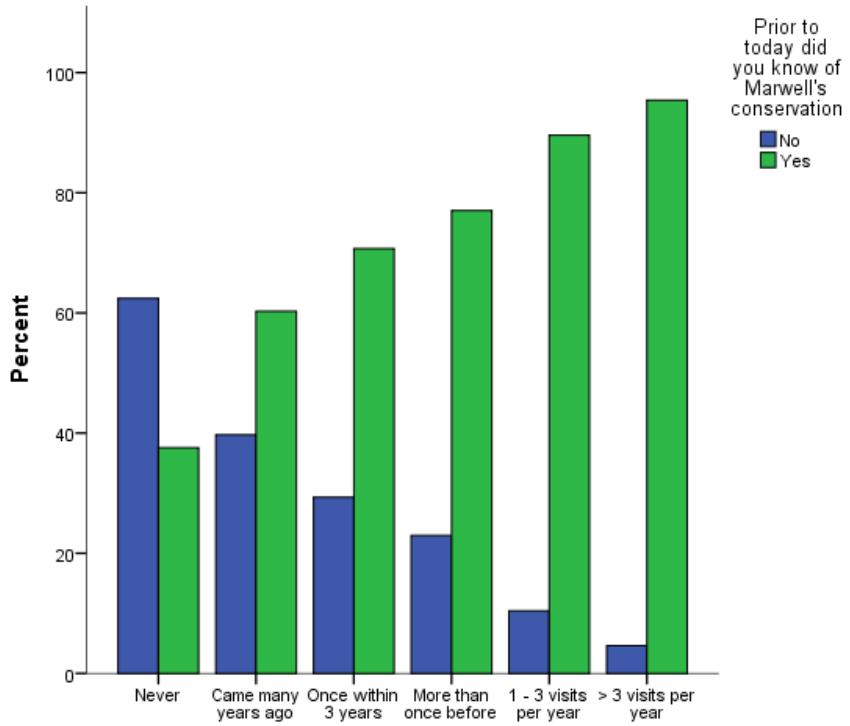


Figure 3-6. Variation in conservation awareness with increasing numbers of previous visits

Those participants who became aware of conservation as a result of their visit did not spend any more or less time in any one location or at animals or in the park overall. Female respondents were slightly more likely to report having seen messages about conservation projects during their visit than male respondents ($F_{(1, 234)} = 5.706$, $P < 0.05$)

3.4.4 Behavioural change

68 participants reported that they might change some aspect of their behaviour following their visit and were able to specify what that change might be. The majority of these changes were to do with increased awareness of wildlife, conservation or environmental issues and supporting wildlife charities (including Marwell), while a smaller number planned to make genuine lifestyle changes in response to their visit (Table 3-17).

Table 3-17. Behavioural change responses

Stated behavioural change	Number of mentions
Visit Marwell Wildlife more often	18
Be more aware of animals, conservation and environmental issues	15
Not buy animal products / skins / fur	11
Adopt an animal	8
Recycle more	5
Change washing powder	5
Reduce carbon / energy	4
Donate to wildlife charity (other than Marwell)	3
Buy / renew annual pass	4
Spend more time with family	3
Buy sustainable options (excluding washing powder)	2
Travel to see wildlife in wild	2
Become a zookeeper	1
Generally be green	1
Spend more time outdoors	1
Drive car less	1

The ‘what not to buy’ exhibit, which provides information on the illegal trade in animal artefacts and skins, made the single biggest impact of any of the messages regarding conservation issues.

Those participants who reported they may change behaviour as a result of their visit spent slightly longer at animals and longer in the park overall. They also covered considerably more distance in the park than those who would not (Table 3-18).

No relationship was found between any of the demographic factors examined and intention to change behaviour.

Table 3-18. Variation in park behaviour for participants who will or will not change behaviour

Participant description	N	Mean time at animals (minutes)	SD	Mean time in park (minutes)	SD	Mean distance covered (meters)	SD
Participants who did not plan to change any aspect of their behaviour	856	78.75	36.96	236.50	70.87	5458	1703
Participants who thought they would change some aspect of their behaviour	68	90.80	39.90	258.25	73.91	6267	1931
Significant difference (ANOVA)		$F_{(1, 923)} = 6.608$ $p< 0.05$		$F_{(1, 923} = 5.895$ $p< 0.05$		$F_{(1, 923)} = 13.913$ $p< 0.001$	

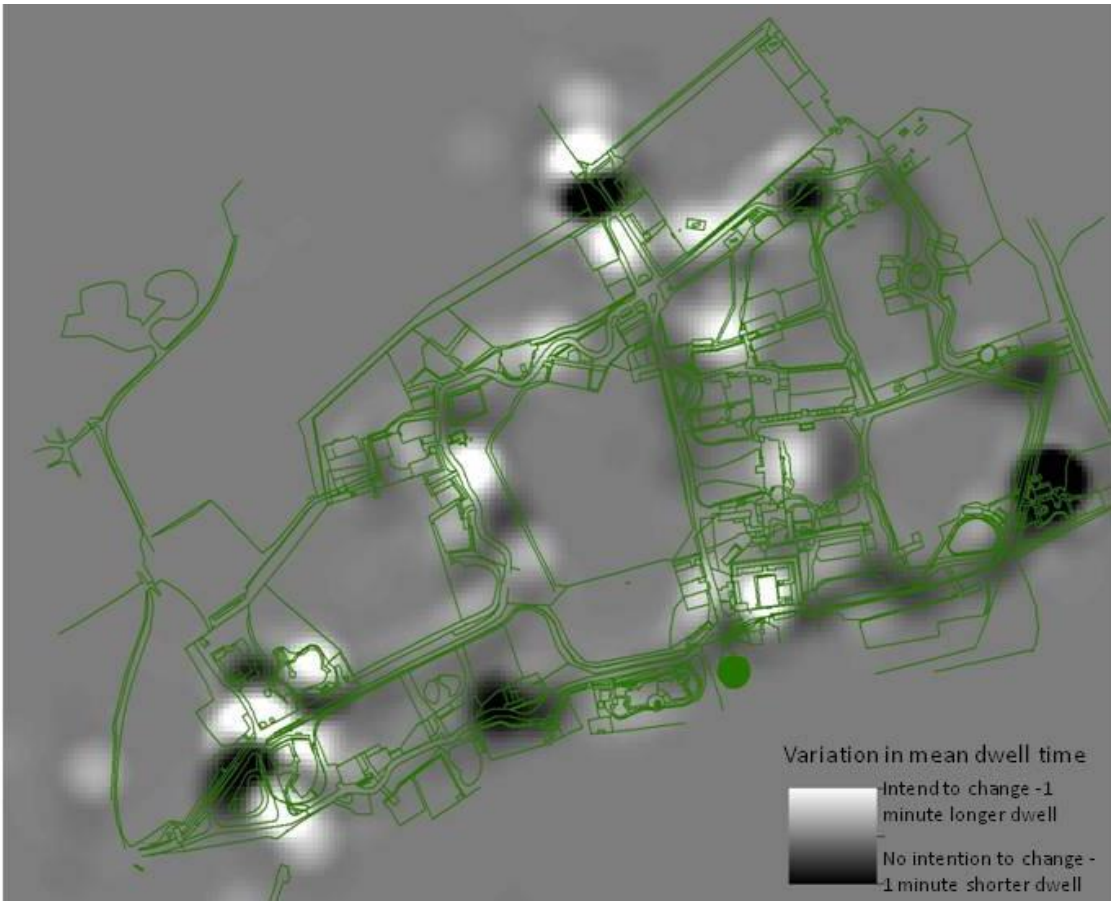


Figure 3-7. Variation in dwell time for visitors who intend to change behaviour and those who do not.

White areas are where those who intend to change spent more time, dark areas are where those who do not spent more time. For example, those who intend to change behaviour spent an average of 5.6 minutes attending to the tropical house compared to an average of 4.3 minutes for those who did not express any intention to change.

3.5 Discussion

The majority of visitors probably did not arrive with the primary intention of learning something about conservation (Ballantyne and Packer 2016). Their goal was more likely to be entertainment (Linke *et al.* 2011) or social interaction with family and friends (Packer and Ballantyne 2002) however having the opportunity for learning may well have influenced their choice of a zoo as the destination for their day out (Packer and Ballantyne 2002; Packer 2004).

In common with previous studies of visitor recall (Hallo *et al.* 2004; Stedman *et al.* 2004; Hallo *et al.* 2012) participants were not very good at remembering which locations they spent most time at, although in most cases they did choose one of their top five locations, as measured by dwell time. The three locations where the most participants dwelt longest (Penguin, Tigers and World of Lemurs) were the most accurately recalled, although at 45%, 46% and 54% respectively, recall accuracy was lower than the 60% observed by Bitgood and Richardson (1986). For all other animal locations accuracy of recall was much lower (≤ 30%) and several animals showed a large discrepancy between number of participants who thought they spent longest there and those who actually did (Table 3-3). This discrepancy may be because the participant saw something interesting or engaging which created a memorable experience, or they may have been bored and the experience simply felt like a long time. By far the most common responses when asked why the participant stayed at a particular location was either: because they liked the animal; or because there was something going on for them to watch. This suggests the former is true and it is the memorable experiences that are standing out in the participant's memories at the end of the day (Tofield *et al.* 2003). The majority of the longest dwell times were at one of only a small number of animal exhibits (Table 3-2). With the exception of the Valley Field, these popular locations were generally the larger ones with more than one viewing point. Exhibit size and the number of different aspects and interpretation elements may be a more important factor in extending dwell than which animal is on show (Falk *et al.* 1985; Serrell 1998; Woods 1998). Animal size has previously been shown to have an effect on dwell time (Yalowitz and Ferguson 2006) but that did not appear to be the case here.

Just less than 25% of participants attended one of the engagement events and of those, just over 50% showed evidence of learning from the event. During the study period the tarantula talk was the only regular formal presentation. This event was the most remembered experience with 15% of those attending events able to recall

information about the tarantula. The other public engagement events were ‘meet the keeper’ events where the keeper fed the animals and visitors were able to ask questions. The success of these events, therefore, relied on the visitors to ask pertinent questions, which may explain the lower number of remembered details from these events. The keepers most regularly gave talks or encouraged questions at the Penguin exhibit resulting in a more in-depth experience which is likely to have contributed to penguins being the second most commonly mentioned animal from events.

Learning from sources other than events appeared to be successful with two thirds of participants reporting that they felt they had learnt during the course of their day and just over half able to give an example (Table 3-10). This is better than other studies which found around 30% of visitors felt they were learning new information during their visit (Smith *et al.* 2008).

The type of information recalled from events was different to that recalled from the other sources. Most commonly recalled from events was information regarding physical characteristics of the animals and details about the specific animals that were the subject of the event e.g. “the tarantula has eight eyes” (Table 3-12). Most commonly recalled from other sources was information about the species as a whole such as “lemur are from Madagascar” or “meerkats can eat meat” (Table 3-12). This probably reflects the type of information available on the animal display signs, with the standard sign present on all enclosures showing species name, distribution, diet and endangered status. Specific information about some species is then provided on supplementary interpretation panels which are not available for all animals.

The single most frequently recalled piece of information was from the Kangaroo enclosure, contrary to the expectation that learning occurs at locations with long dwell times (Balling and Falk 1980; Raphling and Serrell 1993; Borun *et al.* 1996). The Kangaroo is one of the last exhibits encountered before returning the GPS unit hence recency is likely to be a factor (Baddeley and Hitch 1993). The information panel was well placed as the visitor approached the enclosure in a very visible location with few distractions hence is quite likely to be noticed. The piece of information is also short and uses an analogy to a common item easily recognised which also aids recall (Miglietta *et al.* 2008).

The animal most frequently mentioned, when asked about learning from sources other than events, was the okapi (Table 3-13), which was also the subject of the second most commonly recalled piece of information (Table 3-11). This was surprising as only 27% of participants visited the Okapi house. Of all those who did visit the Okapi house,

16% mentioned it during the exit survey compared with only 6.7% mentioning lemur and 3.7% mentioning kangaroo. Dwell time at the Okapi house was above the average for the zoo as a whole, but is not large compared with other frequently mentioned animal locations, such as World of Lemurs or Penguins, hence again dwell time appears not to be the only factor in visitor recall. Birenboim *et al.* (2015) noted that the location offering the best experience is not necessarily the most frequently visited as other factors such as location, animal activity, interaction and exhibit style all come into play. The okapi is an unusual animal in a very quiet and peaceful house. The fact that was most often recalled was about an aspect of its unusual morphology, it can clean its whole body with its tongue. Being in a quiet environment may encourage reflection on the information available and being unusual may well have contributed to its memorability.

Participants who thought they had learnt during the course of their visit overall, either from events or other sources, were found to have spent longer in the park, spent longer at animal locations and covered a longer distance than those who did not (Table 3-14). This supports the hypothesis that longer contact time results in greater learning (Raphling and Serrell 1993; Borun *et al.* 1996) however, it is also possible that those participants most interested or receptive to learning choose to stay longer.

Those reporting learning from other sources also spent significantly longer at certain animals, although in some cases the differences were quite small (Table 3-15). Three of the top five animals most mentioned at the end of the day are at locations where the participants spent significantly longer. The lemur and fossa are mentioned frequently and both are within the World of Lemurs complex where all participants who went there dwelt for over 10 minutes. There was, however, no significant difference in dwell time between those who report learning and those who do not. The World of Lemurs complex is one of the larger exhibits with several species to look at as well as the interpretation panels. The difference in learning may therefore be down to some participants spending more time looking at the animals or socialising while others actively seek out further information. The GPS tracking data is not sufficiently detailed to reveal behaviour within an exhibit such as this, so observational studies would be needed to determine the causes of variation in learning in this area.

Number of previous visits and membership had the largest effect from the demographic data and particularly between members and non-members, with the most frequent visitors and members reporting less learning than non-members and less frequent visitors. A common comment when asked about learning was “I come often so there’s

nothing new to learn", mentioned 22 times. In reality there will be things for these visitors to learn but because they are familiar with the exhibits and the information provided they do not necessarily engage in the interpretation. Regular visitors tend to be well informed already (Lukas and Ross 2005) so it is important therefore to refresh interpretation material periodically and use a variety of interpretation techniques so that the interest of repeat visitors is maintained (Weiler and Smith 2009).

In contrast to other forms of learning, awareness of Marwell's conservation activities increased with number of previous visits. Details of what types of conservation work Marwell were engaged in were sketchy with over half of those who felt they were aware of the conservation activity not able to give an example. These participants typically responded "I know that you do it, but I'm not sure what". There were also many generic responses along the lines of "breeding or working with endangered species" which, whilst true, reveal a limited knowledge that could have been guessed. Of those who said they were aware of Marwell's conservation work, 33.6% could name a species or country that Marwell were active in. Visitors who reported being aware of Marwell's conservation activity spent longer in the park than those who did not, but out of these, participants who gave specific examples spent no longer in the park than the participants who were not able to provide examples. This suggests that a single visit to the zoo may be sufficient to pick up on individual facts but that a longer term relationship may be required to engage the visitor with the conservation message (Morris *et al.* 2012).

When it came to influencing visitors to change behaviour, only a small number of participants (68 or 7.3%) thought that they would. This is significantly less than in some studies (Smith *et al.* 2008) where the percentage stating they would change behaviour was over 50%. In the Smith *et al.* (2008) example, the survey followed a presentation containing specific information about actions visitors could take in their everyday lives whereas at Marwell there was no specific campaign at the time of the survey and relatively few suggestions of behavioural change for visitors to pick up on. Successful campaigns that are effective at stimulating behaviour change involve a strong main message, targeted messaging and a variety of layered interpretation styles (Adelman *et al.* 2000; Weiler and Smith 2009).

Previous research has suggested that overexposure to arguments can have a negative effect on take up (Cacioppo and Petty 1979), particularly with contentious issues, such as climate change, that visitors will have been exposed to away from the zoo. Research in a zoo environment, with messages attempting to change specific

behaviours to benefit wildlife, found that visitors had a personal threshold of message repetitions (Smith *et al.* 2012b) beyond which they are liable to lose interest (Bitgood 2009). Given that all visitors are unlikely to see or hear all examples of calls to action, at least double this number of messages can be used without reaching this threshold level (Smith *et al.* 2012b). At Marwell, those who state an intention to change some aspect of their behaviour as a result of their visit had spent longer in the park and longer looking at animals than those who did not. Emotional connections aid the adoption of new behaviours (Kollmuss and Agyeman 2002; Venkataraman 2009) including experiencing excitement, enjoyment and wonder at animals seen at the zoo (Fraser and Sickler 2009). Participants at Marwell were spending longer at animals because they were watching animals they liked, or seeing something interesting, which resulted in greater learning and greater intention to change some aspect of behaviour, albeit in a small subset of the total visitor population. More work will be needed to see how this intention to change can be converted into actual behaviour change.

3.6 Conclusion

The combination of exit survey and GPS tracking data confirmed that visitor recall is not an effective method of examining where visitors went within the attraction and where they spent time. The locations which stood out in the visitors' memory at the end of their day were those where they had had seen their favourite animal or otherwise had an interesting experience. One limitation of the GPS tracking technique was that the tracking data was not available immediately at the end of the day, meaning it was not possible to ask participants their reasons for staying at the location where they had actually dwelt longest.

The majority of visitors were confirmed as having some sort of learning experience during their visit, particularly those who attended engagement events. The participants who had spent longest attending to animals and in the park as a whole were most likely to report learning.

Likewise those participants who stated they might change some aspect of behaviour as a result of their visit were also those who spent longest attending to animals and in the park as a whole. The number who said they might change behaviour was small and more work will be needed if changing behaviour is to become a significant outcome for the zoo. In other studies the immediate intention to change behaviour following a visit to a zoo or aquarium was not followed through by the majority of visitors (Adelman *et al.* 2000; Dierking *et al.* 2004; Smith *et al.* 2008). The heightened awareness lasted for

a few weeks following the visit and then dropped back to pre-visit levels as habits, routines and social influences in people's daily lives overrode the best intentions to change behaviour (McKenzie-Mohr 2000; Skår *et al.* 2008). Acceptance and adoption of mitigation measures come about through incorporation of new behaviours into a person's identity within the context of their routines, habits and social norms (Thøgersen 2006; Ajzen *et al.* 2009; Swim *et al.* 2010). Given the social nature of a zoo visit, zoos have an opportunity to encourage discussion around behaviours that might be adopted and to encourage social acceptance of alternative behaviours (Luebke *et al.* 2012). Since this stage of the study was undertaken keeper-lead events have been replaced with presentations from public engagement officers who have experience of speaking in public and writing engaging and informative material. This has resulted in attendance at events rising from 20 – 30 at the time of the study to over 100 at each event and more than 500 in total at all events across a typical day, depending on weather (Woodfine 2012). This increased level of engagement should result in more learning at the end of the day and, with the correct messages, more opportunities to inspire changes in behaviour to reduce pressures on wildlife, habitats and ecosystems. More work will be need to evaluate the increased opportunities in the future.

Chapter 4: Environmental behaviour and attitude of zoo-visitors and non-visitors sampled at other local attractions

Abstract

Awareness of environmental issues is widespread in society but there is little evidence that this is being translated into changes in behaviour for the majority of people. A number of explanations for this reluctance to adopt new behaviours have been proposed including habit and inertia, mistrust, denial, lack of understanding of the issues and lack of confidence in solutions. Linear information-deficit models, which suggest more information will increase adoption of a new behaviour, have been shown to be too simplistic. Models that include personal, social and emotional aspects of behaviour are far more successful in reflecting the gap between awareness, attitude and action. In attractions such as aquaria, botanic gardens and zoos, creating an emotional connection between visitors and nature has the potential to engage those visitors in behaviours that reduce habitat destruction and contribute to reversing biodiversity loss. Adoption of pro-environmental behaviours was examined in visitors to a large zoo, and compared with the adoption of those behaviours in visitors to a range of attractions and events who had never visited that particular zoo. A small subset of zoo visitors reported having changed behaviour as a result of their visit and these visitors were shown to have spent longer at animal exhibits than the visitors who had not changed any behaviour. A slightly larger proportion of the visitors to other attractions also reported changing behaviour after visiting an attraction. Overall zoo visitors did not show any greater commitment to pro-environmental behaviours than non visitors. Visitors surveyed at countryside events showed the highest level of participation in pro-environmental behaviours of any of the sites surveyed. An association was found between people who visited nature based attractions and willingness to change behaviour, hence there is scope for the zoo to engage more visitors in behaviour change to reduce environmental impacts and biodiversity loss.

4.1 Introduction

Chapter 3 showed that visitors to the case study location were learning from their visit and that a proportion of the visitors were open to changing some aspect of their behaviour to benefit wildlife following the visit. Chapter 4 reports on a large survey of people within the catchment area of the case study location, but who had not visited it, and compares their reported environmental behaviours and intention to change behaviour following a visit to an attraction with those of the zoo survey participants.

Awareness of environmental issues and concern over topics such as biodiversity loss and climate change are commonplace today (Randall 2011; Globescan 2013) and there is strong support for conservation action (Schultz and Zelezny 1998; Fransson and Garling 1999). This heightened awareness and concern does not appear, however, to lead to the adoption of pro-environmental behaviour at an individual level (Diekmann and Preisendorfer 1998; Armitage and Conner 2001; Bamberg and Moser 2007; Ajzen *et al.* 2009; Packer *et al.* 2010). Behaviour change models based on rational, linear information-deficit models are thought to be over-simplistic (Burgess *et al.* 1998). For low difficulty tasks, for example home recycling, attitude alone can be seen as a good predictor for adopting change through reasoned action models where personal cost-benefit analysis shows a personal gain (Terry 1993; Steg and Vlek 2009). For more difficult, higher commitment tasks, such as using public transport in place of the car, belief in the benefit alone is not enough and other factors come into play (Diekmann and Preisendorfer 2003; Kaiser and Schultz 2009; Moser 2015). A range of factors combine to discourage the take-up of new behaviours such as social norms, mistrust, lack of understanding, habit and inertia, denial and lack of self-efficacy (Diekmann and Preisendorfer 1998; Swim *et al.* 2010). A 2011 survey of the UK population (Randall 2011) found that 96% of people took part in at least one "environmentally friendly behaviour" but 28% admitted that they found it hard to change habits to become more environmentally friendly. Overcoming ingrained habits and regular behaviours requires more than knowledge and understanding as to why change is necessary (McKenzie-Mohr 2000; Jackson 2005). A context that joins the new behaviour with a person's identity is needed to move from intention to change to actual change and bridge the so called value action-gap (Stryker and Burke 2000; Nigbur *et al.* 2010; Newton and Meyer 2013).

Various attractions see themselves as being well-placed to create those connections and couch the need for change in the context of something people can identify with

(EAZA 2004; BIAZA 2011b; National Trust 2015; RHS 2015; WWT 2016). Public surveys have indicated that harm to wildlife and nature is the most commonly held concern regarding the impacts of climate change (ComRes 2017) suggesting visitors to nature based attraction should be receptive to messages aimed at protecting nature. Modern zoos in particular are generally accepted now as places where animal behaviour is studied, and visitors are encouraged to learn more about the animals, their habitats and the threats they face in their natural environment (Catibog-Sinha 2008; Fraser and Sickler 2009; Ballantyne and Packer 2016). Moving beyond informing their visitors about the threats to plants and animals, to actively influencing public opinion and changing behaviour patterns, is something many attractions like zoos express in mission statements (Miller *et al.* 2004; Patrick *et al.* 2007). In some instances this is expressed as 'creating conditions for change' rather than committing to actively changing behaviour (Miller *et al.* 2004; Patrick *et al.* 2007; Matiasek and Luebke 2013). For global conservation action to succeed, individual behaviour change is likely to be required (UNEP 2010; Moss *et al.* 2014).

Whether zoos are in fact effective places of education and learning is debated (Smith and Broad 2008; Fraser and Sickler 2009) but a body of literature is building suggesting that learning outcomes of both formal and informal educational programmes are being achieved (Packer 2004; Yalowitz 2004; Weiler and Smith 2009; Ballantyne *et al.* 2011; Waller *et al.* 2012). Moving visitors from learning about an issue to adopting new behaviours that could resolve that issue is difficult (Adelman *et al.* 2000; Dierking *et al.* 2004; Smith *et al.* 2012a), but has been shown in a proportion of the audience in various studies examining single behaviours (Smith *et al.* 2008; Packer *et al.* 2010). Little work has been done to determine whether this is creating any lasting change in the zoo visitor's behaviour.

Zoos therefore need to ensure they are effective at communicating messages to their visitors and focus attention on what it takes to change behaviour and what their role can be (Kollmuss and Agyeman 2002; Smith 2009). For example, Luebke *et al.* (2012) found 96% of zoo visitors surveyed said they were held back from adopting climate-friendly behaviour by a lack of knowledge of which actions would be best. They also found that, in general, environmental awareness was high among visitors and that a personal connection to animals, and zoo animals in particular, was a significant predictor of both belief in climate change and participation in behaviours to mitigate climate change. Conversely however, Vining (2003) and Skibins and Powell (2013) found a more complex relationship with no clear correlation between making a connection with animals and engaging in pro-environmental behaviour. Visitors readily

connect with specific animals or species and will engage in activities related to these but do not necessarily engage in activities related to the wider environment. Connecting visitors with animals and nature is therefore important in allowing behaviour change to develop, but it needs to be seen in the context of other influences and obstacles to adopting pro-environmental behaviour (Diekmann and Preisendorfer 2003; Magnusson *et al.* 2003; Kaiser and Schultz 2009).

Place attachment can also have a strong influence on pro-environmental behaviour if it is seen as a way to mitigate harm to a favoured location or attraction (Halpenny 2010). Creating a sense of connection to a zoo, as well as with the animals and their habitats, should therefore translate into greater pro-environmental behaviour.

For many visitors, a visit to an attraction is primarily a social experience and learning may, or may not, be a part of that depending on personal preferences and individual or group expectations (Packer and Ballantyne 2002; Falk 2006; BIAZA 2014; Ballantyne and Packer 2016). Discourses aimed at changing behaviour need to be part of this social experience with exploration of ideas led by the visitor if they are to be effective (Allen 2004; Packer 2006). This is particularly true in the case of families with children who are particularly likely to adopt pro-environmental behaviours to protect the future of their child (Berland 2013). The presence of children in a group has also been shown to increase discussion, interaction and learning at exhibits (Borun *et al.* 1996; Puchner *et al.* 2001). Many attractions predominantly attract families with children (Cialdini 2007; Ocean Consulting 2007) so there should be ample opportunities to connect with their visitors through interaction at exhibits. Social marketing campaigns encouraging discussion and sharing of ideas have been shown to be effective in promoting pro-environmental behaviour (McKenzie-Mohr 2000; Owens 2000) but the role education based attractions could play in altering social norms has not been explored (Fraser and Sickler 2009). Interactions between connected individuals create and reinforce social norms (Latané 1981; Latané 1996) which results in less connected sources of new experience having to use stronger messaging in order to gain influence. If an attraction can form a close connection with visitors that they self identify with they will be more likely to adopt new behaviours (Stryker and Burke 2000; Nigbur *et al.* 2010).

The majority of visitor studies done to date focus on individuals or groups, whether they have learnt from their visit, and whether they intend to change behaviour as a result. Some found minimal, if any, impact from a zoo visit (Balmford *et al.* 2007; Smith *et al.* 2008) but elsewhere results have been more varied (Luebke *et al.* 2012). Packer *et al* (1999) were able to show that, for a small proportion of their audience at least, it was

possible to introduce at least one new behaviour from a well-designed interpretative campaign.

Many of these studies used pre and post visit surveys to see if visitors have adopted specific behaviours from targeted campaigns. Little work has been done to determine if the heighted connection to nature anticipated by the institution has been effective at creating a greater commitment to pro-environmental behaviours. A large scale study of visitors to a zoo, and people within the catchment area of that zoo but who had never visited, was conducted to determine if a difference could be discerned. If the zoo is successful in its aim to influence attitude and behaviour (Marwell Wildlife 2015) visitors who spent longer in the zoo on their day out, more time at exhibits and visited more often would be expected to show greater engagement in environmental issues than less frequent visitors or those who had never visited. Understanding how zoo visitors differ from non-visitors and visitors to other attractions aids not only zoo marketing, but could also indicate how receptive the visitors may be to change, or if they are already adopting pro-environmental behaviours through other influences.

4.2 Method

4.2.1 Survey design

In 2010 Marwell Zoo in Hampshire, UK, conducted a large survey and GPS tracking study of visitors to the zoo (chapters 2 & 3). The exit survey (Appendix 4:1) included a series of Likert-type statements on attitudes, behaviours and external influences in relation to environmental impacts. The statements covered a range of behaviours and attitudes that could be influenced by a visit to the zoo. For example, the zoo had an exhibit which explained how reducing aluminium use and recycling aluminium cans can reduce habitat destruction through mining. Ethical purchasing choices and post purchase behaviour promoted at the zoo can therefore reduce habitat destruction (Jackson 2005). Similarly changing travel choices can help reduce climate change impacts (Maibach *et al.* 2009). As a follow-up to this work, a further survey, consisting of the same set of Likert-type statements, was conducted over the summers of 2011 / 2012 at attractions and events within the same visitor catchment area as Marwell, as determined by previous audience evaluation (Ocean Consulting 2007).

For the public survey, a new survey vehicle was created (Appendix 4:2) consisting of the same demographic questions and the same 13 Likert-type statements as the zoo visitor survey. Some minor modifications to certain questions were required as the

public were not being interviewed in the zoo, and were not necessarily with a social group that they might spend a day out with. Two additional questions were also asked to determine why the participant had not visited the study zoo and what types of attractions they liked to visit.

4.2.2 Sampling

Zoo visitors do not necessarily represent a random subset of the general UK population; they are a self-selected group of people who have certain needs or desires on a day out (for example to entertain children) and a certain economic capacity. The Marwell visitor population shows a disproportionately large number of families with children (85%) compared to the general population (nationally 43% of the 18 million families in the UK have children under age 16, Beaumont 2011). With this in mind, when finding a population to sample for comparison it was considered necessary to find locations that would attract a similar population to Marwell but who, for whatever reason, had not been to Marwell. Twenty two sampling locations (Table 4-1 and Appendix 4:3) were chosen that were within the typical travelling time of visitors to Marwell Zoo, measured as one and half hours driving time (Ocean Consulting 2007). All the locations were outdoor spaces or events but they varied in the type of experience on offer and the cost to attend. This ranged from free events (Portsmouth guildhall square Olympic events, town centre surveys, music in the park), free locations but where payment for parking is likely to be needed (beaches, country parks), events with a small entrance fee of an amount similar to parking (Navy open day, Romsey show) and more expensive events in a similar price range to a visit to Marwell Zoo (New Forest show).

Where possible the refusal rate was also recorded, but in locations with large mobile populations this was not feasible (Appendix 4:3).

4.3 Analysis

For the zoo visitors, responses to the Likert-type statements were compared with data from the GPS tracking study (chapter 2) to look for variation in overall length of stay within the park, time spent paying attention to animals, total distance covered within the park and time at catering outlets, retail and playgrounds. The five levels of Likert-type statements were also collapsed down to categories consisting of those who moderately or strongly agreed with each statement and those who moderately or strongly

disagreed. These 'agree / disagree' categories were then compared with the dwell times and measure of distance covered around the park as recorded by the GPS units.

Responses to the Likert-type statements were also compared for zoo visitors who felt they had learnt from their visit, those who had not, and those who were aware of Marwell's conservation work and those who were not.

The Likert-type statement responses were compared between zoo visitors and those who had not visited. Differences were also examined between participants sampled at different types of location with the zoo population represented as one of six location types. The 22 non-zoo sampling locations were grouped into five broad categories for comparison (Table 4-1).

The Likert-type statement responses of the non-visitors were also tested for correlation with the types of attraction these participants liked to visit on a day out.

Table 4-1. Public survey sampling locations categorised by type of event

Category	Locations included
Beach	Alum Chine, Avon, Boscombe, Bournemouth, Hayling Island (East and West) and Southborne beaches (inc Bournemouth Airshow)
Nature / craft / country event	Spring into Summer (an event on Southampton Common), New Forest Show, Romsey Show, Netley Pumpkin Festival
Navy open day	HMS Collingworth Navy open day
Country park	Moors Valley Country Park, Queen Elizabeth Country Park
Other family event	IBM Hursley family fun day; Olympic warm up event and Olympic big screen live telecast, Portsmouth guildhall square; East Parks Southampton, Music in the park, Godalming; Olympic torch relay, Lymington and Salisbury
Zoo	Marwell Wildlife

4.4 Results

4.4.1 Zoo visitors

Overall, little difference was found in reported pro-environmental attitudes and behaviours of zoo visitors when compared with how often they visited, where they spent their time within the park, or with their motivation for visiting. Low levels of

correlation were found between responses to the Likert-type statements and time spent at animals, total time in the park, and total distance covered. While these were significant at $p < 0.05$ and $p< 0.01$ the correlations were weak, ($r_s = 0.1$ or below).

Eighty one participants (8.6%) either moderately or strongly agreed they had changed behaviour as a result of a visit to Marwell. These participants spent slightly more time attending to animals ($F = 6.355_{(1, 661)}$, $p < 0.05$) and less time in playgrounds ($F = 5.697_{(1, 661)}$, $p < 0.05$) than those who disagreed (moderately and strongly) with this statement (Appendix 4:10). These effects were small, considering the sample size, but significant. These 81 participants did not appear to come from any particular demographic or group type, nor were they all regular visitors. Fifty nine of the 81 (66%) did agree that Marwell encouraged them to do more to reduce their environmental impact reinforcing the idea that Marwell is, at least partly, responsible for the change in behaviour.

None of the 13 Likert-type statements were found to show any association with number of previous visits to Marwell, suggesting little impact against these measures with repeat visits. No association could be found in agreement with any of the Likert-type statements that specifically related to participation in pro-environmental behaviours with length of time spent in the park, time spent attending to animals, or time spent at the augmented product locations, again suggested minimal impact against these measures.

Zoo visitors who moderately or strongly agreed with the statement "plants and animals have as much right as humans to exist" were found to have spent less time at catering outlets ($F_{(1, 840)} = 7.331$, $p < 0.01$) and playgrounds ($F_{(1, 840)} = 6.191$, $p < 0.05$, Appendix 4:10).

4.4.2 Demographic variations

Some notable differences were seen in the sampled populations across all the sampling locations (Appendices 4.3 to 4:8). The slight gender bias in participants seen at the zoo was much more extreme at the other locations, particularly in the country parks, where there were more mothers with children. In terms of group types, the zoo appeared to attract less of the 'family and friends' group than other locations, with the exception of the nature / country type events. In age range, the zoo visitors were broadly comparable with the other locations but with a slightly higher number in the 26 - 45 age range. This is consistent with the zoo attracting families with younger children.

In education, the zoo was again broadly comparable with the other locations although the Navy open day showed a lower percentage of participants with the highest education levels. The zoo showed a slightly higher average income amongst its visitors than the other locations. Pet ownership showed wide variation across the sampling locations with only the zoo and Nature / country event visitors more likely to have pets than not (Appendix 4.9).

The demographic variations between zoo visitor and non-visitor, and between participants at different locations was significant and showed a significant impact on certain of the Likert-type statements (Table 4-2). The effects were small but nevertheless the demographic factors were included as factors in subsequent analysis for the statements where an effect was seen.

Table 4-2. Likert-type statements showing significant variation with demographic information

Likert-type statement	Effect	F	p
I recycle or compost all of my home and garden waste	Agreement Increased with age of participant	$F_{(6, 1834)} = 12.952$	< 0.001
I always purchase local produce and environmentally friendly options	Agreement Increased with age of participant	$F_{(6, 1934)} = 4.981$	< 0.001
I always walk, cycle or use public transport for short journeys	household income, lowest income households agreed more strongly	$F_{(6, 1604),} = 2.942$	< 0.01
Adopting environmentally friendly behaviour is important to me	Women agreed more strongly than men	$F_{(1, 1834)} = 6.603$	< 0.01
Adopting environmentally friendly behaviour is important to me	Agreement Increased with age of participant	$F_{(6, 1834)} = 7.601$	< 0.001
I have changed behaviour at home, school or work as a result of a visit to an attraction	Groups consisting of family and friends or just friends agreed more strongly than other groups	$F_{(6, 1715)} = 3.125$	< 0.01
Plants and animals have as much right as humans to exist	Pets owners agreed more strongly than non–pet owners	$F_{(1, 1822)} = 5.631$	< 0.05
Plants and animals have as much right as humans to exist	Agreement Increased with age of participant	$F_{(6, 1822)} = 2.704$	< 0.05

4.4.3 Zoo visitor comparisons with public who had never visited the zoo

One hundred and sixty seven (20.1%) non-visitors reported having changed behaviour as a result of visiting an attraction, over twice the proportion of zoo visitors ($F_{(1, 1688)}$ = 27.242, $p < 0.001$)[14]. Among the participants who had not visited Marwell there was a low, but significant correlation between those who liked to visit wildlife attractions and their agreement with the statement "I have changed behaviour after a visit to an attraction" (Kendall's tau $\tau = 0.125$, CI 0.59 - 0.184, $p<0.001$).

The most significant differences between zoo visitors and non-visitors were found between responses to three statements. Zoo visitors were more likely to agree that “they recycled all waste” and “plants and animals had as much right as humans to exist” but were less likely to agree that they use alternatives to the car for short journeys (Table 4-3).

Table 4-3. Likert-type statements showing largest variation between zoo visitors and non-zoo visitors

Likert-type statement	Zoo visitor or non-visitor	Mean response	SD	$F_{(1, 1688)}$	p
I always walk, cycle or take public transport for short journeys	Visitor	3.18	1.373	26.871	< 0.001
	Non-visitor	3.53	1.376		
I recycle or compost all of my home and garden waste	Visitor	4.27	0.948	12.522	< 0.001
	Non-visitor	4.09	1.149		
Plants and animals have as much right as humans to exist	Visitor	4.51	0.808	10.739	< 0.01
	Non-visitor	4.37	0.986		

The effect of visitor or non-visitor was found to account for more of the variation in response to the statement “I always walk, cycle or take public transport for short journeys” than household income ($F_{(1, 1612)}$ = 14.079, $p < 0.001$ compared to $F_{(6, 1612)}$ =

[14] The question asked to non zoo visitors was less specific than that asked to zoo visitors. The zoo visitors were asked if they had changed behaviour after visiting Marwell Wildlife, rather than any attraction. The results are therefore indicative of a difference, but not directly comparable.

3.740, $p < 0.01$). Zoo visitors showed less agreement with this statement at all levels of household income.

Responses to “I recycle all of my home and garden waste” were found to vary with three of the Likert-type statements assessing other factors likely to influence participants and their attitude to pro-environmental. These were:

- Adopting environmentally friendly behaviour is important to me
- Most of my neighbours recycle
- Being environmentally friendly is difficult for me

These factors were therefore included in ANOVA analysis, along with participant's age previously identified from demographic analysis as affecting responses to this statement. With these other factors included, whether a participant had visited the zoo or not ceased to be a significant predictor of the variation in response (Appendix 10).

Two demographic factors had a significant effect on responses to the statement "plants and animals have as much right as humans to exist": age and owning pets. These factors were therefore included as factors for comparisons of zoo visitors and non visitors. When analysed in combination with visitor or non-visitor, age was the only significant factor ($F_{(6, 1835)} = 2.873$, $p < 0.01$) but this effect was very small.

Of the non-visitors, 25.4% moderately or strongly agreed that "Thinking about Marwell Wildlife encourages me to do more to reduce my environmental impact" compared to 41.2% of zoo visitors.

4.4.4 Comparisons between sampling location types

Variation in responses to the Likert-type statements was found between the different types of location analysed as well as between zoo visitors and non-visitors.

When categorised by location type, significant variation was found between group type, age and gender of participants. The variation in education level and household income was also found to be significant but the effect was smaller; pet ownership did not vary significantly across locations (Appendix 4:11). These were therefore included as factors in analysis as appropriate. The statements showing the significant variation across different sampling location types are shown in Table 4-4.

Table 4-4. Likert-type statements showing significant variation between location types

Likert-type statement	Location type and factors affecting variation in response	Mean response	SE	F	p <
I recycle or compost all of my home and garden waste *(with most of my neighbours recycle and age)*	Countryside event	4.232	0.117	3.923 (5, 1833)	0.01
	Beach	4.010	0.104		
	Zoo	3.999	0.091		
	Country park	3.938	0.160		
	Other event	3.929	0.120		
	Navy open day	3.477	0.160		
	Age of participant			8.395 (6, 1833)	0.001
	Most of my neighbours recycle			11.351 (4, 1833)	0.001
I always purchase local produce and environmentally friendly options *(with age and I have friends who choose environmentally friendly options)*	Countryside event	3.713	0.113	2.682 (5, 1835)	0.05
	Other event	3.206	0.116		
	Zoo	3.101	0.062		
	Country park	3.093	0.113		
	Navy open day	3.076	0.138		
	Beach	3.075	0.095		
	I have friends who choose environmentally friendly products			22.384 (4, 1835)	0.001

Table 30 continued. Likert-type statements showing significant variation between location types

Likert-type statement	Location type and factors affecting variation in response	Mean response	SE	F	p <
I always walk, cycle or use public transport for short journeys *(with household income)*	Countryside event	3.577	0.101	3.401 (6, 1612)	0.01
	Beach	3.517	0.101		
	Other event	3.473	0.154		
	Country park	3.343	0.117		
	Zoo	3.191	0.049		
	Navy open day	2.825	0.313		
	Household income			3.882 (5, 1612)	0.01
Adopting environmentally friendly behaviour is important to me *(no significant contributions from demographic data)*	Countryside event	4.322	0.067	6.225 (5, 1845)	0.001
	Beach	4.082	0.049		
	Country park	4.028	0.057		
	Zoo	4.019	0.026		
	Other event	3.924	0.069		
	Navy open day	3.721	0.106		

The age of participant and how far the participant agreed with the statement "most of my neighbours recycle" had a larger effect on the participant's commitment to recycling than where the participant was sampled.

How far the participant agreed with the statement "I have friends who choose environmentally friendly options" had a much larger effect than sampling location on the participant's commitment to sustainable purchasing options.

Household income had a comparable size effect to sampling location on responses to "I always walk, cycle or take public transport for short journeys". Participants from households with higher income were less likely to agree with this statement.

Participants sampled at the "countryside events" consistently showed the greatest level of agreement with all of the pro-environmental behaviours and attitudes, while zoo visitors tended to be in the middle or, in the case of car use, at the lower end of the spectrum. External influences may be a factor in these differences. For example zoo visitors were less likely to have friends who choose environmentally friendly products ($F_{(1, 1842)} = 8.733$, $p < 0.01$) than non-visitors. Post Hoc analysis (Tukey HSD) indicated that participants sampled at countryside events were most likely to have friends who choose environmentally friendly products ($F_{(1, 1842)} = 7.928$, $p < 0.001$).

None of the locations tested agreed that being environmentally friendly was difficult. Women disagreed more with this statement than men ($F_{(1, 1832)} = 15.447$, $p < 0.001$) and younger participants were more likely to disagree with this statement than older ones ($F_{(6, 1832)} = 7.092$, $p < 0.001$). The gap between the genders reduced with age.

4.5 Discussion

Awareness of environmental issues and threats to wildlife and ecosystems is well embedded in the UK today and the majority of the participants surveyed disagreed that "being environmentally friendly was difficult". Translating that awareness into positive action and behavioural change, however, does not automatically follow (Diekmann and Preisendorfer 1998; DEFRA and ONS 2011; Randall 2011). With around 25 million visitors each year, and a clearly stated goal to change behaviour in those visitors (BIAZA 2011b; BIAZA 2014), attractions such as zoos should, in theory at least, be in a good position to bridge the gap between attitude and action.

A small percentage of zoo visitors did feel they had changed behaviour after a visit and that the visit had contributed to the change. The 8.7% of participants who reported changing behaviour after a zoo visit is similar to the 7% seen by Packer *et al.* (2010) suggesting zoos can have an impact, but they may only impact on a small part of their total audience. This small percentage is unlikely to be sufficient to create a new social norm for pro-environmental behaviour on its own (Rydin and Pennington 2000), hence zoos need to find ways to inspire behavioural change in a larger proportion of their audience. A larger proportion of the non zoo visitors felt they had changed behaviour after visiting other attractions (including other zoos) suggesting people are open to new ideas in the right context.

In this study the zoo visitors were no more environmentally friendly than the non-visitors and in respect of using alternatives to the car were slightly worse. Other studies in the UK have found similar results with demographic differences accounting for more of the variation in attitude than a zoo visit (Balmford *et al.* 2007). Research at Chicago and Lincoln Zoological Society found that the higher income and higher educated zoo visitors were more enabled to take action than non-zoo visitors who tended to have lower income (Luebke *et al.* 2012).

Participants sampled at Countryside events consistently showed greater participation in pro-environmental behaviours than zoo visitors. Are the types of people who attend these events more engaged in pro-environmental behaviour than zoo visitors, or are these events better able to communicate environmental messages, perhaps by focussing on local impacts and on UK native species and habitats? Stewart and Craig (2001) found that regular visits to natural, functioning ecosystems were more strongly associated with pro-environmental behaviour than visits to constructed environments such as zoos. As a zoo in a rural location Marwell may be able to use the functioning

natural habitats within and surrounding the zoo to support their messages. For example, although currently various areas are planted with native meadow flowers and grasses, there is little in the way or signage explaining what is planted or the reason for it. The heat, humidity, smells and lush foliage of exhibits such as tropical houses are highly immersive and evocative of functioning ecosystems. The grasslands populated by zebra, rhino and antelope or the lakes populated with flamingos are also ecosystems and more could be done to bring the visitor into closer proximity of these habitat types.

The attitudes of a person's social circle influence behaviour with those closest to an individual, both emotionally and physically, having the largest effect (Latané 1981; Latané 1996; Ajzen *et al.* 2009). Studies which have found zoo visitors show more environmental awareness then the general population also found that these visitors were more likely to have friends who were environmentally aware than the general public (Clayton *et al.* 2013). In this study the zoo visitors were slightly less likely to have friends who adopted pro-environmental behaviours and did not show any greater pro-environmental behaviour than the non-visitor. The visitors to Countryside events, who were more likely to have friends who demonstrate pro-environmental behaviour, were more likely than the zoo-visitor to display pro-environmental behaviours themselves. Zoos therefore need to address the way in which they tackle behavioural change and where to target resources. Should they focus their efforts on areas where they appear to be having some effect (recycling, environmentally friendly purchasing) or do they tackle the hard-to-change behaviours like car use? Ultimately this is likely to come down to the opportunities for messages within the individual park. For example, city zoos that are accessible by public transport may have more opportunities to promote sustainable travel than rural zoos that are only accessible by car. Other studies have found that zoo visitors were more aware and more amenable to adopting pro-environmental behaviour than the 8.7% found here (Packer *et al.* 2010; Luebke *et al.* 2012; Clayton *et al.* 2013) where making emotional connections with nature and animals were found to be key factors in promoting pro-environmental behaviour.

People are strongly swayed by external influences. In this study the influence of neighbours and friends appeared to have a significant effect on participation levels on certain behaviours. In particular two results stood out:

- Agreement with I recycle or compost all of my home and garden waste was most strongly influenced by whether neighbours also recycled

- Agreement with purchasing local produce was most strongly influenced by the having friends who also chose environmentally friendly products

Shaw (2008) noted that the influence of the behaviour of neighbours is limited by the linear distance and number of other houses between them. Hence, while there may be a relationship between the recycling behaviour of the participants and the observed behaviour of their neighbours, this is not necessarily a causal link. If behavioural change does occur because of an 'in group' call to join rather than 'out group' pressure dictating action (Armitage and Conner 2001; Nigbur *et al.* 2010), the zoo needs to be seen as being 'in the group', encouraging visitors to 'join' them in changing behaviour, rather than using dictatorial or accusatory language as they may have in the past (Owens 2000; Jackson 2005). Stimulating discussion around issues and the effectiveness of changing behaviour, and seeing or meeting with other people who share your views, can have a greater impact by creating a sense of being part of a solution rather than a problem (Latané 1996; O'Riodan *et al.* 1999; Owens 2000; Luebke *et al.* 2012).

Attractions such as zoos are seen as trusted sources of information by their visitors (Luebke *et al.* 2012; Clayton *et al.* 2013 and chapter 5). The correlation between visits to wildlife attractions and willingness to change behaviour suggests many people are open to calls to action from this type of organisation so calls to action presented by these institutions have a better chance of being acted on than a call from a less trusted source (Stern 1999). To date, the focus of interpretation at Marwell has been on species characteristics, behaviours and conservation with relatively little information on threats or actions visitors could take to reduce biodiversity loss. Emotional connections with individual animals or species, however, do not necessarily result in adoption of behaviours that reduce environmental harm beyond that particular species (Vining 2003; Skibins and Powell 2013). Marwell aims to "connect people with nature" (Marwell Wildlife 2017a) hence the organisation needs to foster not just a connection with the visitor's favourite animals, but also with other species that populate the same habitat and more broadly engage visitors in areas they may not previously have discovered. They also have the opportunity through repeat visitors, to take advantage of both the place attachment effect and in-group willingness to act to encourage changes in behaviour (Halpenny 2010). The absence of any difference in reported behaviour change, or intention to change, between members and non-members or frequent and less frequent visitors suggests the zoo is not making the most of this relationship at present. The potential in-group effect with engaged visitors will be explored further in the next chapter.

Having children inspires adults to change behaviour (Berland 2013). Not only does the birth of children inspire parents to change their behaviour to provide for their children, the presence of children also inspires greater learning, faster adoption of new ideas and a more hopeful attitude to the future (Berland 2013). Exploring with children and discussing information aids learning in both adult and child, so education attractions catering to families should be able to promote pro-environmental behaviour, if the message can be couched in appropriate terms (Borun *et al.* 1996; Puchner *et al.* 2001). In chapter 3 of this study small groups of just adults (parents or grandparents) with children were less likely to learn than other groups. Interpretation materials need to be designed to stimulate discussion between adults and children to capitalise on the opportunities presented by the presence of children (Wineman *et al.* 1996; Ridgway *et al.* 2005; Moss and Esson 2010).

Changes in behaviour are likely to take place over time with influences from many sources (Ballantyne *et al.* 2007; Hughes *et al.* 2011). The results reported here were collected over three years: zoo visitors in 2010 and non-zoo visitors in 2011 and 2012. Changes in the national and regional picture during this period may have influenced the results. A 2005 recycling survey reported that 87% of Hampshire respondents agreed that they recycled all or most of everything that could be recycled. This compares with 80.1% of all survey participants over the full 3 year period, 83.2% of zoo visitors in 2010 and 86.8% of countryside event visitors (the highest in this survey) in 2011/12. Recycling rates in Hampshire fell over four years from 24.04% in 2010 to 22.41% in 2013 (Keely Gallagher 2014). It is not known if this change is due to a reduction in participation or a reduction in segregation effort (Thomas 2001) but it may be that the recycling participation of zoo visitors, as sampled in 2010, was different to that sampled in 2012. The differences in recycling participation found here between zoo visitors (2010) and non-visitors (2011/12) could, therefore, be a factor of a wider drift in societal recycling rates rather than an actual difference between sampling locations. DEFRA saw a similar decline in environmental concern over the period 2007 - 2011 (DEFRA and ONS 2011).

4.6 Conclusion

The results reported here indicate that visitors to a range of attractions were open to adopting new behaviours, or modifying existing behaviour, to reduce environmental impact. A proportion of visitors to Marwell were found to be engaged in pro-environmental behaviour, but no more so than non-visitors in the region. More of the

non-visitors said they had been influenced by a visit to an attraction than zoo visitors said they had been influenced by their visit to Marwell. Participants appeared to be open to calls to action, particularly from wildlife attractions, so there is clear scope to engage more visitors in changes in behaviour to reduce threats to biodiversity. Marwell will need to increase the number of messages regarding actions visitors could take, and demonstrate the effectiveness of taking those actions, if they are to achieve their aim of changing visitor behaviour (Marwell Wildlife 2015).

Nationally, Randall (2011) found 32% of the population believed they were "environmentally friendly in most or everything they do". Here only 8% of all participants moderately or strongly agreed that they displayed all three of the behaviours referenced in the Likert-type statements. The different way in which the question was phrased by Randall will probably account for much of the difference between the results reported here and in Randall's national survey but it is clear more work is needed for Marwell to demonstrate they are achieving their aim to influence behaviour.

This part of the study was conceived to test whether there was a measurable difference in participation in pro-environmental behaviours between visitors to the case study location and members of the public in the local area who had not visited. Visits to the zoo were found to be having an influence, but so were visits to other attractions. Although participants surveyed at the locations outside of the zoo had not been to Marwell, 86% stated that they did enjoy visiting nature based locations (wildlife attractions or parks and gardens) on days out. Some of these locations will have similar intentions to affect behaviour as Marwell (BIAZA 2011b; Merlin Entertainments 2015; RHS 2015). The analysis in this chapter, and in the later focus groups (chapter 5), found that while wildlife and nature based attractions can be effective in changing behaviours, they do not exist in a vacuum. People are exposed to many different influences, some of them conflicting, from a range of sources and determining the impact of the attraction from among these is difficult. Although Bonferoni was not applied in this instance, it is clear that the effects reported here are small and that multiple influences are likely to be having an effect. More work will be needed to distinguish the impact of a visit to an attraction from the other influences people are exposed to. The possible implications of this change in approach for individual attractions wanting to measure impact are picked up in chapter 7.

Chapter 5: Longitudinal effects of regular visits to an attraction

Abstract

Where the impact of a visit to an attraction such as zoo or museum has been measured at all it is almost always measured during or immediately after the visit. This method may be effective at evaluation of short term learning and immediate emotional response, but it cannot tell us anything about longer term change in attitude or actual change in behaviour. Various attractions have commitments to provide education for visitors that not only passes on knowledge, but also inspires the adoption of behaviours that reduce or reverse the loss of local or global biodiversity. In order to demonstrate behavioural change in visitors exit surveys are not sufficient, it is necessary to follow them over longer periods of time. This represents a time commitment that is beyond the reach of the majority of institutions. In this study annual pass holders who had been regular visitors to Marwell Zoo in Hampshire for a number of years were invited to take part in focus groups to investigate the affects of the longer term relationship. Participants discussed how they felt their attitudes had changed over the time they had been visiting the zoo and what factors not related to the zoo visits might be influencing those changes. A range of factors were identified with the zoo visit having a large influence on a small number of participants, but with external factors being far more influential for the majority. The possible reasons for this are examined and the implications for future exhibit development and improved messaging are discussed.

5.1 Introduction

Chapters 2 to 4 reported on surveys of visitors to attractions, their learning and their intention to change behaviour following a visit. Short answer and Likert-type questions can only reveal a certain amount about the influence of the attraction over time and multiple visits. To gain a deeper understanding of the influence of the case study location on repeat visitors who have been visiting regularly over a number of years, a series of focus group interviews were convened. Key points raised during these interviews were also posed to followers on social media. The participant's attitudes towards learning opportunities and their willingness to listen to calls to change some aspect of their behaviour are examined. The role of the attraction as a trusted source of information and the level to which regular visitors connect with the organisation is also explored. The influence of the case study location is compared to other sources of influence raised by the focus group participants.

Many visitor attractions including museums, zoos, aquaria, stately homes and botanical gardens have a strong educational message and a desire to change attitudes and behaviours. A single visit may not be sufficient to inspire change on its own, but continued exposure over time may lead to adoption of new ideas and behaviours (Everett and Barrett 2009). An attraction’s membership and regular visitor base should therefore be a rich source of information on the effectiveness of calls to action.

5.1.1 Learning, awareness and behaviour change

Learning from visits to education oriented attractions can be difficult to demonstrate (Tunnicliffe *et al.* 1997; Balmford *et al.* 2007; Jacobsen 2010) but has been shown in a subset of visitors from a range of attractions (Adelman *et al.* 2000; Packer 2004; Ballantyne and Packer 2005; Rennie and Johnston 2007 and chapter 3). In those instances where learning has been shown to have taken place, moving visitors from learning about an issue, to adopting new behaviours that could resolve that issue is also problematic (Adelman *et al.* 2000; Dierking *et al.* 2004; Smith *et al.* 2012a) but again has been shown in a proportion of the audience (Smith *et al.* 2008; Packer *et al.* 2010).

Learning is seldom the primary motivation for visiting an attraction (Falk 2006; Dawson and Jensen 2011), entertainment and spending time with family or friends are much more common. Learning has, however, been suggested as a secondary motivation for

choosing an education attraction as a destination over alternative types of attraction on a day out (Dingfelder 2009). The majority (70%) of visitors to Marwell Zoo stated that learning about wildlife was a motivator for choosing Marwell as the destination of their day out (chapter 2). Discussion and interaction at exhibits is valued by those visitors who see their visit as a family bonding opportunity (Stoinski *et al.* 2002; Fraser 2009) and can also be an important contribution to the learning experience (Borun *et al.* 1996; Meredith *et al.* 1997; Puchner *et al.* 2001).

Learning happens over time (Skidmore 2003) and repeat visitors who are already engaged or interested in the subject matter are more likely to learn (Falk and Adelman 2003; Lukas and Ross 2005). A moderate positive correlation has been shown between environmental or conservation knowledge and pro-environmental behaviour (Oskamp *et al.* 1991; Diekmann and Preisendorfer 1998; Straughan and Roberts 1999; Coyle 2005). People who have been visiting an educational attraction for many years might be expected therefore, to have acquired more knowledge and be more receptive to change in behaviour (Yalowitz 2004; Morris *et al.* 2012; Pearson *et al.* 2013) but a causal link has not been shown. Oskamp *et al.* (1991) and Diekmann and Preisendorfer (1998) both found conservation or ecological knowledge was a predictor of both environmental consciousness and the ability to translate that into environmental behaviour, however, the proportion of people who managed this translation was low. On its own, greater awareness is not sufficient to bring about lasting behaviour change (Kollmuss and Agyeman 2002; Lukas and Ross 2005). Discarding previously held beliefs is very difficult and may need more than a convincing argument or provision of more information (Anderson *et al.* 2003; Jackson 2005). An attraction may be successful in raising awareness and visitors may leave with the best of intentions to change some aspect of their behaviour, however, these are not followed through by the majority (Adelman *et al.* 2000; Falk *et al.* 2007; Smith *et al.* 2008; Smith 2009).

In the Diekmann and Preisendorfer (1998) study more environmentally conscious people were more likely to partake in sustainable behaviours, but the number of behaviours for any one individual was low and tended to be easy 'low cost' actions with minimum personal penalty. More significant actions, that may require some form of lifestyle change, are more difficult to implement (Jackson 2005) either through identifying with the beneficiary of the change or through a personal benefit such as saving money. Having a personal or emotional connection to nature and animals aids learning, has been correlated with environmental identity and is an important predictor of pro-ecological behaviour (Mayer and Frantz 2004; Gosling and Williams 2010; Luebke and Matiasek 2013; Powell and Bullock 2014). A visitor who can identify with

the behaviour on a personal level, and know that it fits with their self image, is more likely to adopt new behaviour (Ajzen 1991; Skår *et al.* 2008; Ajzen *et al.* 2009). Confirming an existing position is far easier than discarding it (confirmation bias) so in order to change beliefs and ultimately behaviour, the argument must be both compelling and acceptable to the individual's identity (Lilienfeld *et al.* 2009; McCright and Dunlap 2011; Schwering 2011).

5.1.2 Evidence of long term behavioural change following a visit to an attraction

Exit surveys carried out at attractions can evaluate intention to change behaviour and compare visitor intentions with those of non-visitors (Falk *et al.* 2007; Smith 2009 and chapter 4) but to demonstrate that an intention to change has been carried through requires further contact at a later date to confirm the behaviour has been adopted (Adelman *et al.* 2000; Smith *et al.* 2008). Where these longitudinal studies have been carried out, they tend to have been designed to evaluate the impact of individual campaigns which targeted specific behaviours the institutions were hoping visitors would adopt and hence had a target for investigation. Some of these campaigns and subsequent evaluation have demonstrated adoption of the target behaviours (Yalowitz 2004; Smith *et al.* 2008), but take up of the actions was low and evidence of attitude shift appears to be limited. Evaluating the response of repeat visitors over time to their overall visit experience, and whether this leads to emotional connection or changes in behaviour, does not appear to have been studied (Esson and Moss 2013). In the absence of a specific campaign, but a stated desire to engage people in conservation, how can the institution evaluate their progress towards these goals?

The majority of UK zoos have a stated aim to achieve conservation success through education of visitors (Patrick *et al.* 2007; BIAZA 2017a). The presence of exotic animals provides the opportunity to engage visitors on a personal level (Kellert *et al.* 1996; Luebke *et al.* 2012), allowing them to introduce actions the visitor could take to reduce biodiversity loss. Annual pass holders and repeat visitors to attractions are likely to have been repeatedly exposed to messages and hence may be more sympathetic to the ideas they are expressing (Jensen 2009). Repeat visitors to Marwell Zoo, for example, were more likely to be aware of the conservation activity of the zoo than less regular visitors (chapter 3). This greater awareness did not, however, translate into a greater intention to change any behaviour following a visit. Changes in behaviour take place over time and are influenced by many sources (Ballantyne *et al.*

2007; Hughes *et al.* 2011), so demonstrating behaviour change and separating the zoo influence from other factors is likely to be difficult and require contact with visitors over many years. The studies which have attempted to show the adoption of new behaviours needed to contact visitors several weeks or months following their visit to confirm whether they had followed through with their commitment to adopt new behaviour (Taylor 1993; Dierking *et al.* 2004; Smith *et al.* 2008). This is a significant time commitment that may well be beyond the resource of many institutions and has no guarantee of obtaining a useful number of responses. The majority of institutions have some form of annual pass or membership which allows them to keep in contact with regular visitors. This pool of engaged individuals represent a chance to explore the learning and behavioural change opportunities of a longer term visitor relationship.

To gain a better understanding of why the greater awareness of regular visitors did not appear to translate into behaviour change a series of focus groups were convened. Focus groups were chosen in place of more quantitative methods to allow a more open and free exploration of the affective response of repeat visitors

The purpose of the focus groups was to determine:

- If frequent zoo visitors valued the learning opportunities of their visits
- What other sources they might also be learning about biodiversity from?
- Whether they were receptive to calls to action and if their behaviour is influenced by these?
- What other sources (if any) also influence them to adopt new behaviours?

5.2 Case study: Marwell Zoo

Marwell members were chosen as the test pool for this study as, although they are not representative of day visitors, they represent a group with the highest level of contact with Marwell, both in person through visits to the zoo, and through the receipt of newsletters and e-mail updates.

5.3 Method

A series of five focus group sessions were held in November 2014 with between five and eleven participants at each and thirty five participants in total. Participants were recruited via the membership e-mail list and through posting on the Marwell Wildlife Facebook page. Participants were required to have been members for at least two

years and to attend the zoo regularly each year, i.e. in the >3 visits per year category from the visitor survey (chapters 2 & 3).

The focus groups followed a typical design of Krueger (2002) and Millward (2012). Each was timed to last for an hour with six questions allotted ten minutes each, although in reality the amount of discussion around specific questions varied considerably between groups. The moderator had a script with an introduction and the six questions (Appendix 5:1) so that each group was presented with the same information and asked the same questions. The discussion topics were also projected onto a large screen to help keep participants on topic.

Also in attendance at each session were a scribe who took notes and recorded each person's first words to help identify who said what and a 'devil's advocate'. The role of the devil's advocate was to raise subjects that participants may not feel comfortable talking about (MacDougall and Baum 1997). For example the focus groups were held at the zoo so participants may have initially felt uncomfortable being critical while at the zoo and in front of a staff member. For each topic of discussion the devil's advocate had one or more negative points to raise if these did not come up in conversation naturally. On some occasions these points came up naturally and there was nothing for the devil's advocate to add, while on others the devil's advocate raised the negative issue and sparked further discussion.

Focus groups allow participants completely free expression of how they feel about a particular topic and allow development of ideas through discourse with others (Kidd and Parshall 2000; Millward 2012). They are, however, time consuming which results in a limited numbers of participants and makes it inappropriate to extrapolate from the participants to the wider audience (Sim 1998). To try and alleviate this limitation somewhat, some of the most common responses to key questions from the focus groups were then posed to a wider audience via Marwell's Facebook page to obtain wider input and potentially stimulate further discussion (Lupton 2012). Followers of the Facebook page are also typically repeat visitors and hence represent a similar participant pool to the focus groups.

5.4 Analysis

Each focus group session was recorded on two Dictaphone recorders and transcribed into the Nvivo software package for analysis. The transcripts were analysed and nodes

created for each new idea or concept put forward in response to the questions. A total of 75 nodes were created.

By coding the different topics / ideas / concepts a quasi-quantitative count of how frequently these came up is possible (Stoll-Kleemann *et al.* 2001; Lorenzoni *et al.* 2007). Given the discussion regarding whether the fundamental unit of analysis is the group or the individual (Massey 2011; Millward 2012), attention was paid to how many participants stated a given point of view and in how many focus groups a particular point of view was raised. More weight was given to the latter, as a topic being raised independently multiple times is more indicative of the prevalence of this point of view than several participants in a single group agreeing with an idea once it has been raised.

No attempt was made to extrapolate from the focus group members to the wider membership population, but the concepts raised were compared with the results of the opinions of Marwell Facebook followers. The concepts were also compared to the stated intentions to change behaviour and actual reported behaviours of the visitors to Marwell and people who had never been as reported in chapters 3 & 4.

5.5 Results

All participants were members who had been visiting Marwell zoo for a minimum of two years (median seven) and who visited on multiple occasions, ranging from three visits per year to more than once per week. Participants visited with different groups, alone (for example to take photographs), with a partner, with wider family or with groups of friends. Most participants also visited other zoos when on holiday or otherwise travelling to other parts of the country.

5.5.1 Question 1. Where do you find information on nature, wildlife, conservation or biodiversity

When talking generally about where participants had learnt about wildlife throughout their life television programmes, and particularly those of David Attenborough, were mentioned most frequently and by all groups (Table 5-1). For many people ‘growing up’ with David Attenborough was, for them, a key feature of their current positive feelings towards wildlife.

> I think most of the information I've heard about wildlife is from David Attenborough (...) the various series over the years. Participant 31

When more specific information was wanted about wildlife or biodiversity ‘the internet’ was the most common response given by the largest number of participants and by all groups. Unlike television, which was being watched as a leisure activity, the internet was cited as a reference source where participants went if they wanted specific information, for example for a child’s homework, for what they might see at a particular holiday destination or in response to something had seen on a zoo visit.

> The internet is obviously a favourite (...) I think the internet probably covers just about everything nowadays when you want to find out anything. Participant 27

and

> My friends with their youngsters we would encourage them to look on websites and learn from that as well as watching TV programmes. Participant 34

Talks at other zoos and other attractions such National Trust properties were cited as good sources of information by participants from 4 of the 5 focus groups. In particular costume characters at National Trust properties were highlighted by one group as a particularly effective way of engaging with the subject matter.

> I'd say the National Trust (...) have really sort of upped their game around the experience because when they do the kitchen talks they have someone dressed up as the maid who acts the part (...) and it's not a long time but you feel more part of the experience. Participant 6

Various other forms of information sources were suggested by smaller numbers of participants (Table 5-1). Two participants took part in conservation activities or biodiversity related hobbies and cited these as a source of learning.

Only two participants said that they were not interested in finding out more information about wildlife or biodiversity but both agreed they enjoyed watching David Attenborough.

Table 5-1. Question 1: Where do you find information on nature, wildlife, conservation or biodiversity

Answers	Participants giving this response	Number of focus groups where this response appeared
Internet	13	5
TV	12	5
TV - David Attenborough	7	4
Talks at other attractions	6	4
Books	4	2
Marwell Zoo website	2	2
Not interested in looking up more info	2	1
Participation in activities (e.g. bird watching, conservation volunteering)	2	1
Travel or holidays	2	1

5.5.2 Question 2: How do you feel about learning on a day out?

Opportunities for learning were popular with participants from most groups and from Facebook followers (Table 5-2). Some participants were very positive about learning opportunities and sought these out, particularly if they had children, while others felt it was nice to have the opportunity for learning available if something piqued their interest. For example one Facebook responder said:

> [Nice to have] if just me and my husband.
>
> [Something I look for] definitely when children with us

While another said

> Always nice to learn something new, but not necessarily the reason for a day out.

One participant from the focus groups noted that learning opportunities were only really relevant to children above a certain age.

> [Opportunities for learning are] nice to have. We don't actively look [for information] only because my children are young. Participant 28

Conversely for others their visits to Marwell were recreational or social and they did not want to be bothered with having to read information or listen to talks.

> I like learning stuff about the animals but (...) my favourite animals, like the snow leopards, I don't like reading too much information, because I'd rather just enjoy watching them. Participant 25

One participant contrasted a visit to Marwell Zoo with a visit to a museum saying:

> I think it's different if I'm going to a museum where I would feel that the primary activity was learning, especially if it's a museum I've not seen before, I'd go with a different approach, but for here I'm mainly coming to relax. Participant 31

Table 5-2. Question 2a: How do you feel about learning on a day out?

Answers	Number of focus group participants giving this response	Number of focus groups where this response appeared	No of Facebook responses n = 47[15]
Nice to have	10	5	30
Something I look for on a day out	5	4	24
Important for children	5	3	3
Visit is recreational, mainly come to look not to learn	4	2	0
Learning is not a reason or not the main reason to visit Marwell	4	3	0

[15] Some respondents on Facebook gave more than one response

5.5.3 Question 2b. How do participants prefer to receive information when on a day out?

During the focus group discussions about how participants felt about learning on a day out, many of the groups talked about the different ways in which they liked to receive information (Table 5-3). This was such a popular topic in the focus groups that the most commonly raised ideas were also included in the questions posed on Facebook (Appendix 5:1).

Formal talks were popular, but the opportunity to talk and ask questions more informally was the most frequently mentioned topic, with all focus groups raising this as means of interacting and over half of the focus group participants mentioning this specifically. Some wanted to talk to staff to get a better understanding of the individual animals, their behaviours, likes or dislikes and breeding plans, while others were more interested in the insider view of what it was like being a keeper.

Interactivity was a common theme such as talking to staff, interacting with signs with lifting flaps or wheels or handling artefacts. For example

> We went to the bird place and they had a little interactive table there which the little girl I look after thought was amazing and she actually started asking questions to the keepers (...) that was really interesting to have something to pick up and hold and they love looking at skulls and things. Participant 22

Touch tables and handling of artefacts was mentioned by the largest number of groups as an experience they liked and a good learning method. Also highlighted by a partially sighted lady who liked Marwell but wanted more of this type of thing that allowed her to experience the animals

Identification signs were the most popular answer from the Facebook followers but were not preferred by the majority of the focus group participants. The focus group participants did want there to be signs with basic information but for more detailed information they preferred other methods of learning.

Ideas for more interactive exhibits were put forward such as touch screens to discover more if you wanted to and apps with information, games or video clips. Apps were mentioned in 4 of 5 focus groups as a good way to find more information for those who wanted it. These ideas were seen as a good compromise between having a big sign

that was too complicated and would not be read and having lots of information on the website but which you cannot look up until you get home, by which time you've forgotten the question or lost interest. Audio guides such as those used in museums and art galleries were suggested by respondents from 3 groups, although they did acknowledge that these can create crowding at the locations described in the guide. Others disliked audio guides but thought in the form of an app on their phone that they had with them anyway they could be interesting.

All sources wanted more information on individuals such as name, age, where the individual was from (i.e. born here or from another zoo) and relationship to other animals. The participants felt this helped them, and particularly their children, to 'identify' with the animals and form an attachment which may make them more sympathetic to changes in behaviour.

> The giraffes, they've got all the names, which my niece and the little girl I look after they absolutely love the giraffes (...) she's not even 2 yet and she knows [who] Ruby the giraffe is. Participant 22

> I think it's one way that helps children to engage with a particular animal. Participant 8

Four focus group participants suggested "nuggets" or titbits of interesting and engaging information would be easily digestible and might spark more interest rather than lengthy details which could put people off even starting to read. Once engaged they might then feel inclined to go to an app or interactive sign to find out more.

> I like to know what I'm looking at (...) I want something, not huge massive screen, cos you don't have time to read it, but just a reasonable amount of info so you see the thing (...) and you can relate to it. Participant 2

> You see a little bit of information which actually sparks other questions about the animal (...) I'm going to look that up [later] and go and see what that's about (...). But what I wouldn't have done [was] read a massive sign with various facts about it. Participant 29

Table 5-3. Question 2b. How do participants prefer to receive information on a day out?

Answers	Number of focus group participants giving this response	Number of focus groups where this response appeared	No of Facebook responses n = 110
Informally talking to staff member or volunteer	20	5	4[16]
Mobile app	14	4	1
Interactive signs	13	4	2
Animal encounter	11	2	N/A
Formal talks	10	4	72
Audio guides	10	3	N/A
Touch tables with artefacts	7	4	53
Video	4	4	1
"nuggets" of information	4[17]	2	N/A
Signs	3	2	75

[16] The multiple-choice Facebook question did not allow for a distinction between formal talks and talking informally to volunteers or keepers. Only those followers who specifically mentioned conversations with staff or volunteers were counted in this instance

[17] At the groups where this topic was raised several voices around the table agreed but all at the same time so it was not possible to gain an accurate count

5.5.4 Question 3: How does Marwell Zoo compare with other sources of information?

Participants did not feel Marwell (either the zoo or its website) was as good as their favourite sources of information mentioned in question 1 (Table 5-1), but they did feel it was comparable with other zoos (Table 5-4). A desire for more information was the most common response, particularly about the conservation work that their visit supports but also about individuals and the interesting 'takeaway' facts as mentioned in question 2b (Table 5-3).

> Well obviously it's not going to be as good as watching David Attenborough. Participant 2

> There are some areas of Marwell which have examples of the conservation work that Marwell is doing readily available but it's very patchy. Participant 35

> More information on the breeding programmes would be really interesting. Participant 23

Newer areas of the zoo were considered good with participants from 4 of the 5 groups citing interactive features and new signs as being informative and engaging.

> The walk in aviary information on the fur feathers bit at the front I think is very good, becuase it's not too in your face but there's a lot of information there. Participant 34

Some noted that the information provided was very good for children but also felt that the information was possibly too exclusively focussed on children

> Very often it feels like [the talks are] geared to children, which is great, but I don't feel there's many opportunities when, as just two adults visiting, we can dash up and ask the guide something. Participant 31

As regular visitors, some felt they had read or heard the information that was available and there was not enough that was new or different to engage them in further learning. The participants connected this to the previous topic; they wanted the opportunity to talk to staff to get more in depth information, particularly about the wider conservation work of Marwell.

> Quite often we've looked at animals here and thought we'd like to know more about them and there really is virtually no information up at the enclosure other than (...) the name and whether they're endangered. Participant 30

As with question 1, participants from 4 of the groups cited talks at other types of attraction, such as stately homes, as what they considered to be exemplars of better presented information.

One participant in each of four focus groups felt that information provision at Marwell was poor. These participants were aware of the species information but wanted more information about Marwell's conservation work or to know more about individuals, such as where their favourite animal had gone to.

Table 5-4. Question 3: How does Marwell Zoo compare to other sources of information?

Answers	Number of focus group participants giving this response	Number of focus groups where this response appeared
Would like there to be more	12	3
Would like there to be more on conservation work	9	3
Variable - new areas are good but older areas are still poor	8	4
Comparable with similar organisations such as Paignton Zoo	6	4
Poor	4	4
Good for young children but poor for older children or adults	4	3

5.5.5 Question 4: How do requests for you to take action to protect biodiversity make you feel?

All focus groups and Facebook followers felt that messages about threats to biodiversity were important. This was the topic that generated the most discussion during the focus groups (Table 5-5). Focus group participants thought requests to take action were important but tended to think about the messages in terms of how they would impact or be received by others, particularly children, rather than themselves. For example:

> I think it's a good thing because I think more people need to be aware. Participant 34

> I think it's very important that the kids learn that they can't waste everything, they don't need every light on in the house. Participant 19

> If people don't want to look at it then they won't look at it and they won't take action. I think it is important to let the people that might not be aware how important it is. Participant 22

But despite thinking the messages were important, some focus groups participants did not think they would take action themselves, even though they thought the messages interesting or important. For example:

> I think it's [energy efficiency messages] interesting but I don't think I would take any notice of it. Participant 5

> At the Orang-utans they were talking about the destruction of the Malaysian and Indonesian rainforest for palm oil and there was a 'you might want to think about the products you buy and whether they have palm oil in them' [message] and I have to confess that I haven't taken a great deal of action as a result of that. Participant 1 (discussing visit to Edinburgh Zoo)

Participants from two groups discussed having seen messages asking visitors to take action at other locations such as aquaria or wildlife parks which they thought was good.

> They've [New Forest Wildlife Park] got a bit about picking up your rubbish and how dangerous it is to native wildlife. Participant 23

> I know from going to the marine places, the whole thing about pick up your litter, don't leave plastic bags, things like that, they get home to the children. Participant 28

> I have seen them at [the] aquarium in Portsmouth (...) one of the exhibits (...) says how much wastage do you have, what could you do when you go home to save this? [I]t's like an interactive screen so the boys like and played and thought it was quite good fun (...) It was interesting to do it with my sons because they say why have we got to walk to school mum (...) it's quite interesting to be able to explain that again and justify. Participant 12

The majority of focus group participants did not respond about whether they were likely to take action themselves until specifically prompted for this information in Question 5. Facebook followers were given 'want to help' as a multiple choice option and 64% of followers gave this response (Table 5-5).

Many participants qualified their agreement with calls for action, saying that these needed to be positive and have some relation to what they were looking at. Some participants felt calls to action worked better when there was context or an explanation of how an action might help.

> I think the difficulty is trying to tie what we do at home as ordinary consumers to how it would affect the type of animals that you have here at Marwell. So how does turning off lights affect the Zebras? Participant 13

Others noted that messages that raised awareness of issues that could help them as well as address threats to biodiversity, were most likely to be effective and that examples of best practise were also helpful.

> The water boards used to give out little bags you put in your sistern (...) we're on metered water so it saves me money so I'd be a fool not to use it but I didn't know about them before someone told me about it. Participant 13

> I quite like places that offer an example of good practise and then suggest how you can continue that at home or work. Participant 33

Participants from all of the focus groups felt calls to action could be a negative experience, if they felt they were being preached at or patronised or if the issue was beyond their ability to help. One participant was very forthright:

> I come on a day out for fun to relax and I don't want to be guilted into thinking oh my goodness I should be doing this, the world's being destroyed because of this. If it was presented in a light hearted way or a factual way hopefully we would take the message away that way rather than feeling like we're back at school. Participant 32

Participant 30 was less emphatic but agreed that messages should be not be too demanding.

> I always think it's very interesting and educational if it's presented more as a fact not as a you need to go home and do this this and this. Participant 30

Others were less concerned or sympathetic towards those who might feel guilty

> I think it's important to have it there, if you feel guilty then that's you feeling guilty but you can choose not to do it (...) I think it's important that it is there, whether they want to hear it or not, we need to start thinking conservation and the children need to realise. Participant 22

Ethical sourcing such as Fair Trade was picked out by one focus group as an example that could be seen as negative due to perceived higher cost and lack of choice.

> That's preaching, that's taking away the customer choice (...) You're not giving us the option to say I won't buy all the things you've decided are not good stuff (...) if I put myself in the shoes of a day tripper that actually might annoy me. Participant 14

Some threats to specific species were seen as too big or too remote for them to be able to make any meaningful contribution to reduce the threat.

> You can talk about ivory and not to support the ivory trade but realistically how many visitors are actually going to go out and buy a piece of ivory? (...) people want to be able to relate to action they can postively take rather than some [facts] that are just, you know beyond most visitors. Participant 32

> We came and there was a talk about Rhino's wasn't there ... about how they were being hunted in Africa and there was a lot of information about it. But you did go away and I thought what can we do to make a difference about this? Participant 30

But they did agree that practical actions were more important than accusations and that there were things that could do.

> I think it is important to let the people that might not be aware how important it is, the simple things you can do, they don't have to be life-changing. Participant 22

> I think you're more likely to take action on the sort of fun things like the RSPB feeding birds and building a bug hotel and things like that. (...) I mean my little niece built a bug hotel and she thought it was great but if I told her to turn the lights out she wouldn't take any notice at all, she'd forget because it wouldn't be interesting. Participant 8

> You might think, well these people are destroying all of this rainforest well what can I, I can't actually go out there and stop them myself but (...) there's lots of little things that I can do. Participant 6

> It's good to have practical ideas about what you can do to help rather than just knowing all of the problems but feeling powerless to do anything about it. Facebook follower

Table 5-5. Question 4: How do requests for you to take action to protect biodiversity make you feel?

Answers	Number of focus group participants giving this response	Number of focus groups where this response appeared	No of Facebook followers giving this response n = 28
Participant feels it's important the messages are there, even if they may not engage with the particular action themselves	21	5	25
Calls to action are good provided they are not "preaching" or accusatory	13	4	N/A
To be effective calls to action need to be given context	9	4	0
Like to see examples of best practise achievable actions I can take	8	3	N/A
Requests to take action can be a negative experience	8	3	1
Participant feels they are already environmentally responsible and do not need more messages but feels these may be necessary for others	6	3	N/A
Calls to action are good, I want to know what I can do to help	2	1	18

5.5.6 Question 5: Do you take action to preserve biodiversity?

Sixteen participants, spread over all focus groups, felt they had changed behaviour to help to protect the environment or biodiversity, although not necessarily in response to specific messages (Table 5-6).

> Yeah, I think we did (...) and we're sort of concious of the things I buy and it was mostly about the lighting in your house and heating and things like and walking to and from school rather than taking your car on sort journeys. Participant 12

> I definitely recycle everything I can now and I'm trying to get my two boys to put things in the recycling bin more rather than just putting it straight in the rubbish bin and I get them to turn off lights when they've finished. Participant 33

Some specific actions to protect wildlife were mentioned, such not dropping plastic bags that could get into the ocean or cutting up the plastic rings that hold drink cans in a pack.

> We go to Hayling [local tourist beach] quite a bit and I pick the rubbish up off the beach. Participant 27

> Those four can things, if you just snip through the four of them with a pair of scissors before you throw it in the bin there's no bird's ever going to get trapped. Participant 21

A small number from one focus group felt they were taking action because they were told to (recycling at home) or which conferred some personal benefit (saving money).

> I do try and turn my lights of but again from a selfish point of view it's so my bill isn't higher (...) and I think a lot of people do try and do these things but I think money is generally a driver behind a lot of this action. Participant 32

While others felt that if there was a cost and no personal benefit they would probably not take action

> It comes down to cost. Because if it's got little cost, or it's got a cost benefit to you, then I think you do it. If it's going to cost you a lot more

> money and you're going to get nothing from it then quite often you move on. Participant 13

> We've had dilemas where we've looked at the green energy tariff vs the tariff that's being offered us that will be a lot cheaper (...) then you're forced to think well how far do we follow our principles or does it really come down to the money. Participant 31

Three groups discussed adopting sustainable behaviours when they were younger but were not sure that they would change behaviour now in response to any new messages.

> I've been vegetarian since I was 16 (...) and I'd use public transport (...) But actually making a choice these days to change your behaviour I think you do get stuck in your ways. Participant 1.

> I think one probably does [engage in sustainable behaviour], well at my age I think I probably took it in a long, long time ago. Participant 18

Other also referred to the difficulty of breaking the habits of a lifetime.

> It's difficult, you get stuck in your ways, like my dad won't recycle at all and I've met a few people his age who just won't do it and they don't see the impact on future generations. It's just, I've done this all my life, this is what I do. Participant 28

> When you get to our age you're a bit more set. Participant 27

Participants could remember seeing calls to action at other attractions which had inspired them to take action.

> I was definitely inspired about the palm oil by what they said at Paignton [Zoo]. Participant 2

Table 5-6. Question 5: Have you taken action or changed behaviour to preserve biodiversity in response to messages?

Answers	Number of focus group participants giving this response	Number of focus groups where this response appeared
I have modified behaviour but not necessarily in response to messages seen at zoos or other attractions	16	5
I Take action because it's expected or to save money not to save environment	4	1
I've been inspired to travel to see animals in the wild	2	2

5.5.7 Question 6: Has something you have seen at Marwell Zoo been influential in your decision to make a change or adopt a behaviour

A small number of participants (four from two groups) thought Marwell was responsible for their adopting environmentally friendly behaviour (Table 5-7).

> I would say, yes it has, it's changed my outlook a lot. I saw changes in my family probably because of my changes, stamping my foot, my parents saying you will recycle, no you should turn the tap off when you brush your teeth and all of those sorts of things and my sister who's a few years older than me who had the same educational experience as me has also been very much influenced by Marwell, so yes, I would say it's influenced our outlook. Participant 23

> As child going to zoo, just being able to know and learn about them inspired me to help try and do bits like that if I could. Participant 34

A larger number (seven participants from four groups) felt visits to Marwell were one influence among many that contributed to their desire to adopt sustainable behaviour.

> Yes, but that's because of a whole range of different reasons. But yes I think generally society is more aware of everything that's happening. Participant 5

> I tie up plastic bags now to go in landfill and I cut the plastic can things for hedgehogs etc. (...) It's all little things like that, so it has worked. Participant 28

Seven participants from three groups felt the opportunity to see rare animals up close was inspirational and raised awareness, although it did not necessarily inspire them to take specific actions.

> I wasn't aware of how many species were so endangered (...) so many of them in Marwell are endangered or even extinct in the wild and it's made me much more aware of that. Participant 30

> Even if they go away just having seen one animal that they wouldn't have seen and considered, it's going to be an inspiration. Participant 20

> It is a very important part of our life, and all the family's. Participant 18

For the majority, however, other sources of information were thought to be more significant, with society being generally more aware of threats to biodiversity.

> I think it's just natural progress with all the information that's in the news these days and the fact that we're making the children aware you know of what the impacts are you know on the environment, I think we're all aware now we have a responsibility. Participant 24

The flexibility of television and other media were given as examples of how other sources of information were likely to be more influential than institutions such as zoos.

> Yes, I think media is always going to have a bigger part to play in that kind of message than any one organisation generally can because the media can give that drip drip feed, they can change the message and morph it so it's almost constantly there. Whereas I think an organisation like this, you'll see the message once and if perhaps you're like some of us who come back time after time you probably won't necessarily read it again for quite some time becuase you know you've read it so yes I think the media do have a bigger part to play than an organisation. Participant 32

Some participants noted how seeing endangered animals at the zoo made them pay more attention to those animals when seen at other sources, including contributing to fund raising campaigns.

> I think for us probably the snow leopards, it's made us more aware of the plight of snow leopards and when programmes are on TV or even if a world wildlife advert comes on it does make you more aware and you do actually absorb that information more when you've actually seen that animal in the flesh. Participant 24

> because you're so close to them it makes a huge difference, it makes them more real. Participant 23

> The biggest thing I do is probably make more financial contributions to different organisations who can then make more of a difference in other countries because I personally can't do it myself so the only thing I think that I can do is support them financially. Participant 5

Participants from two groups mentioned that they'd been inspired to travel to see animals in the wild.

> I think seeing them here's made me realise how I really want to go there so it does inspire you to want to see them in the wild. Participant 22

One of these was inspired to travel using environmentally conscious travel companies.

> I think it's influenced me to want to do more safari type travel and go with companies who have got eco-crendentials. Coming here often inspires us to think of trips we'd like to take and then we're quite mindful of who we'd go with. Participant 31

Several participants stated that they did not expect to be inspired, that was not why they came.

> Does it inspire us to rush home and start supporting various projects? No it doesn't, we've come for the day, we go round, we have a good day, we go home and get on with our lives. Participant 13

These participants felt that paying for membership or for day entrance was how they contributed to tackling biodiversity loss.

> If you think we're coming here to be inspired and change the world, I'm sorry I don't think we are. We're doing our bit by paying you our membership, paying you the ticket at the gate, we're having a good time, the moneys being used to save these lovely animals, everyone's won. Participant 14

> But I think that if we know that by going [and] having our entertainment with our families or our friends that actually every time we come to an entertaining place like Marwell it is doing all that behind the scenes then we're more likely to encourage other people to do it. Participant 13

Table 5-7. Question 6: Has something you have seen at Marwell Zoo been influential in your decision to make a change or adopt a behaviour

Answers	Number of focus group participants giving this response	Number of focus groups where this response appeared
I've seen calls to action at Marwell but have not acted, it should do more to engage visitors	10	4
I've seen calls to action at other attractions that have been influential	8	4
I do not feel that Marwell influences me to change	7	4
I take action as a result of many sources of information, Marwell may have contributed but not necessarily	7	4
Visits to Marwell Zoo keep the wonder of natural world fresh in my mind	7	3
My entrance fee contributes to preserving biodiversity	4	2
Visits to Marwell Zoo do contribute to my changing behaviour	4	2
I have donated to conservation organisations in response to calls for action	2	1

5.6 Discussion

5.6.1 Participants like learning about biodiversity and value the chance to learn on a day out.

The members taking part in the focus groups were interested in learning about nature and wildlife and liked having the opportunity to learn on a day out. This latter was also true for the Facebook followers. A subset of both focus group participants and Facebook followers actively sought out attractions to visit that included learning opportunities, either for themselves or their children. In the focus groups there was a particular desire to learn more about the conservation activity of Marwell Wildlife. This agrees with the findings of Yalowitz (2004) but is in contrast to a qualitative survey of tourists near Paignton Zoo[18] which found that many assumed the zoo did conservation work but did not necessarily want to know much about it (Dr Amy Plowman 2015, personal communication 23rd March). This difference may reflect the greater engagement of the members who visit regularly as compared to infrequent visitors and the general public (Jensen 2009; Morris *et al.* 2012).

When it came to comparing different sources of information for learning about wildlife television programmes were considered the best source but some types of attractions (aquaria and National Trust properties) were also highlighted as having interesting learning opportunities. Smith and Broad (2008) discussed the abundance of information available through the media and suggested an attraction could have a complementary role by reinforcing messages and adding context. Palmer *et al.* (1999) and Jackson (2005) noted that environmental beliefs were strongly associated with significant people so admired household names such as David Attenborough, who was mentioned many times, can have a significant impact on the adoption of environmental ideas.

For a day visitor the contact time at the zoo (average 4 hours, chapter 2) is less than the total viewing length of a typical BBC wildlife documentary, for example Planet Earth II was six hours in total (BBC 2016). Furthermore the information presented on this type of programme is the distillation of many hundreds of hours of observation so it is perhaps not surprising that the learning potential is higher. For the regular visitors involved in the focus groups, who visit the zoo for many times each year with contact

[18] Paignton Zoo, Paignton, Devon. http://www.paigntonzoo.org.uk/

time in excess of 100 hours each in some cases, the learning opportunities should be far greater, if the information is available to learn from.

Participants felt the case study location had some interesting areas and they enjoyed talking to, and obtaining information from staff. In some areas, however they felt information was not refreshed often enough for their liking and staff were not always available to ask questions. This agreed with the exit survey findings in previous work (chapter 3) that found members and regular visitors did not feel they had learnt from their visit as they did not believe there was anything new available for them to learn, highlighting the importance of refreshing messages to maintain interest for repeat visitors (Weiler and Smith 2009). Whilst it may have been true that were no new signs for them to read, they may well continue to learn by observing the animals and gaining greater understanding of animal behaviour without being aware that they are learning (Ballantyne *et al.* 2007; Luebke *et al.* 2016). It should be noted however that watching is not the same as observing and that many visitors may lack the necessary pre-knowledge to interpret what they are watching without some form of guidance (Hmelo-Silver *et al.* 2007; Krombaß and Harms 2008; Yamahashi *et al.* 2015).

5.6.2 The information presentation method was important for learning on a day out

In some studies visitors have been found not to read signs (Bashaw and Maple 2001; Dingfelder 2009) while others have found that some groups do read them depending on the sign, the makeup of the group and the motivation for visiting (McManus 1989; Ross and Gillespie 2009; Waller *et al.* 2012). Both the focus group participants and Facebook followers stated they like having signs for basic information about an animal and for short memorable ‘take-away’ facts. The memorable nature of these short facts was highlighted in the exit survey (chapter 3) where the most remembered piece of information was a sentence describing the size of a kangaroo at birth. Large text based signs, however, were not popular with the focus groups, for more detailed information they preferred interactive methods of learning. Talks, exploring artefacts, interactive signs or exhibits and question and answer sessions were all popular. The participants highlighted the effectiveness of getting children engaged via fun activities. Engaging children this way can have a knock on effect on the adults as they pick up learning and adopt behaviours their children have learnt about (Vaughan *et al.* 2003).

5.6.3 Visitors are open to calls to action and believe potentially negative messages have their place.

The majority of participants and Facebook followers wanted to know about negative impacts on biodiversity even if they were difficult messages. This agrees with the Stoinski *et al.* (2002) who found zoo visitors did feel zoos should be tackling and informing them of these difficult subjects. A small number of participants qualified this saying that difficult information needed to be presented matter-of-factly and that they did not want to be made to feel guilty when they were on a day out to relax. Solutions need to be inclusive with the potential for personal reward and avoid accusatory discourses (O'Riodan *et al.* 1999; Owens 2000; Jackson 2005). Many of the focus participants used inclusive language saying 'we' rather than 'you' when referring to Marwell, for example participant 14 said “we want to increase footfall”. The participants appeared to feel they were part of something and wanted it to succeed. With this level of engagement it should be possible for attractions such as Marwell to lead by example and ask visitors to join them in taking action.

In a similar vein, many of the focus group participants did not object to seeing difficult messages. They felt that calls to action were a good thing, but these needed to be in context of what they were looking at. Participants from 3 groups, for example, could remember seeing calls to action at aquariums and some felt they had taken action, either themselves or with their family, in response to those messages. The connection between littering and oceans was seen as a simple and familiar one, a picture of a dolphin or turtle tangled in some litter was easily understood. The majority of the messages that participants could remember as being effective from any attraction were about litter. Littering as a message has been around for a long time in the UK (Keep Britain Tidy 2015), so has had time to seep into the vernacular of many people and preventing littering is considered a part of everyday life in many areas (Cialdini *et al.* 1990; Weaver 2015) with strong social pressure to comply (Cheung *et al.* 1999; Ajzen *et al.* 2009). Introducing new behaviours is more difficult and participants felt context would help them to understand the importance of adopting changes. Participants were unclear how calls to action, of the type they had seen elsewhere, could be used at the zoo because they could not see an immediate link between actions such as turning out lights and issues such as the conservation of zebra.

In the public survey (chapter 4) 20.1% of non-visitors agreed moderately or strongly that they had changed behaviour following a visit to an attraction, compared with only 8.6% of Marwell visitors who agreed moderately or strongly that they had changed

behaviour following a visit to Marwell. The focus group participants stated that they were more aware of messages at other attractions, particularly sea life centres, than at Marwell. The participants appeared to feel that the messages at other attractions were more relevant and therefore more likely to influence their decision to act. A proportion of the focus group participants, however, were able to give specific examples of behaviours they had been inspired to change or adopt over the years they had been visiting Marwell, particularly those who had visited as children. Others felt that their visits to Marwell and seeing animals 'up close' was inspirational and uplifting generally, but could not think of any examples of actions it had inspired them to take.

The majority of the focus participants group felt they were already 'green' and had made changes to their behaviour some time ago and were therefore less likely to adopt new behaviours now. Some participants felt that changing behaviour was something you did when younger and then habits became established that were hard to break.

Engrained behaviours and habits are the hardest to change (Jackson 2005; Randall 2011) so more than just awareness of the issue is needed to enact a change (McKenzie-Mohr 2000). For relatively low cost actions that are easy to achieve, such as recycling or not littering, awareness and attitude towards the action is a good predictor of engagement (Terry 1993; Steg and Vlek 2009). For more difficult actions with a higher personal cost, such as not driving or not updating a mobile phone, lack of a perceived personal benefit becomes an issue (Magnusson *et al.* 2003; Kaiser and Schultz 2009) and the cost-benefit equation is tipped against adopting the behaviour (Diekmann and Preisendorfer 1998). The perceived personal cost of changing behaviour can be significantly higher than the perceived benefits, either personally or for biodiversity, particularly if those benefits are remote or sometime in the future as it is for climate change impacts (Stoll-Kleemann *et al.* 2001; Kollmuss and Agyeman 2002; Diekmann and Preisendorfer 2003) resulting in a reluctance to adopt new behaviours.

The focus group participants demonstrated this cost-benefit equation through various comments suggesting they would take part in actions that had personal benefit, such as saving money on electricity or water, as well as benefit to wildlife. Context became important where the personal benefit may be lower but they could see that the behaviour had an impact on what they could see. The impact became more 'real' (Kollmuss and Agyeman 2002) and identifiable rather than distant and nebulous when looking at the okapi and reading a sign about mining destroying their native habitat. As

participant 1 revealed, however, when discussing her lack of action following the orang-utan and palm oil talk at Edinburgh Zoo, making the connection may not be enough.

The focus groups were keen to have examples of best practice and small actions they could take that would be affective. Several also noted feelings of futility in the face of some threats to biodiversity that were beyond their ability to alleviate. The ability to make a meaningful contribution and the efficacy of a given action to address an issue is important in the adoption of any new behaviour. The behaviour needs to be within the control of the individual and at the same time needs to be effective in contributing to the solution (Terry 1993; Straughan and Roberts 1999; Bamberg and Moser 2007; Luebke *et al.* 2012). Some respondents in the exit survey reported achievable actions such as 'increasing recycling to combat climate change' but do not tackle more difficult actions such as restricting travel when, in the majority of cases, the latter would likely have a larger impact (Whitmarsh 2009; Osbaldiston and Schott 2012). Behavioural change is not necessarily a step change in multiple behaviours at once, it is more likely a continuous process of small changes that only look like big changes in hindsight (Jackson 2005). The small behavioural changes reported by participants may be 'entry point' behaviours which lead to larger changes later on, but conversely there is a risk they could lead to feelings of complacency where individuals feel they are doing their bit and do not need to adopt more difficult changes (Thøgersen and Crompton 2009).

This may have been the situation expressed by several of the focus group members who stated that they felt their membership, entrance fee or donation to specific causes was how they responded to the threats to wildlife. A similar sentiment was expressed by participants in the exit survey (chapter 3) some of whom said their behaviour change would be to 'come back more', 'adopt' or 'become a member'. The funding brought by visitors is essential to continuing the conservation work done by institutions such as zoos (Catibog-Sinha 2008) but on its own it will not be sufficient action to tackle an individual's contribution to biodiversity loss through impacts such as climate change and resource consumption (MacAskill 2017). If properly framed, however, the engagement and donation of the visit may be they type of entry level activity that an organisation can build on. As was reported in the Paignton zoo study above, knowing that something is being done to alleviate biodiversity loss creates a feel good factor of supporting the zoo and contradicts the feelings of futility. If the organisation can show that success is possible then the actions an individual can take may seem more worthwhile (Thøgersen and Crompton 2009).

5.7 Conclusion

This chapter set out to investigate how visitors with a long term relationship to an attraction felt about learning opportunities, how receptive they were to messages asking for changes in behaviour and whether they were likely to change, or had changed already, in response to what they saw, heard or read at an attraction.

Learning about wildlife was important to the majority of focus group participants reflecting their high level of engagement with the subject matter. For both focus group participants and Facebook followers, learning was at least something they looked for in a venue for a day out even if it was not the primary reason for the day out.

The focus group participants revealed several examples of changes they had made based on something they learnt at an attraction, but also that many other factors were influential in deciding to take action. The focus group participants felt that Marwell was an inspirational experience and that the opportunity to see animals, particularly their favourites, up close was inspirational and uplifting. In this they appear to be making the emotional connections that can lead to behavioural change (Kollmuss and Agyeman 2002; Fraser and Sickler 2009; Venkataraman 2009) although not all follow this through. Learning about the conservation activity of Marwell was part of this inspirational experience and several participants would like to know more about it. Of the eight participants who stated that they would like to learn more about the conservation activity, five already took action to reduce their impact on biodiversity and one wanted more information on action they could take. These participants had understood the clear connection between littering and harm to wildlife seen at other attractions but were less aware of how their own actions could be impacting on the animals being conserved by Marwell, other than not purchasing illegally traded animal artefacts.

At the time of the focus groups there were only a small number of displays suggesting actions visitors could take relating to the animals they could see. In the exit survey (chapter 3) repeat visitors were no more likely to engage in the suggested pro-environmental behaviours than less frequent visitors. The small sample of highly engaged individuals present in these focus groups, however, does appear to show a willingness to listen and act on environmental messaging, providing it is presented in a way that the audience can identify with. Technological solutions to providing information were popular with the focus groups so there may be scope for more novel, interactive based approaches to information in the future, such as apps with location

based information, virtual reality or gamification of learning. Multilayer interpretation using more than one media has been suggested as means to improve visitor learning (Weiler and Smith 2009; Schwan *et al.* 2014). In the case of these focus groups, however, although technological solutions were popular, none of the participants had any experience of any using more advanced applications of interpretation so it was impossible to tell whether this enthusiasm would translate into using technology if it were available.

As was stated at the outset, the focus group participants were not representative of the majority of zoo visitors but they should be indicative of the most engaged visitors. Some authors have argued that efforts to change behaviour should focus on just this sort of visitor, those who have an affinity for the cause and are therefore most likely to change (Anable 2005). These regular visitors therefore may be an opportunity for change that Marwell has yet to fully exploit.

A single attraction cannot expect to change the behaviour of all of its visitors so possibly the best an educational attraction can hope to do 'creating conditions for change' (Miller *et al.* 2004; Patrick *et al.* 2007; Matiasek and Luebke 2013) and inform its guests, reinforcing knowledge gained elsewhere (Falk *et al.* 2007; Falk and Dierking 2010).

As Chawla (1999) found, exposure to the natural world can have a profound effect on a subset of the population. The results here suggest that for a small number of individuals the impact of a visit to an attraction can be similarly profound. One focus group participant explained how she had gone on to study biology and now taught biology following visits to Marwell as a child and a participant in the public survey (chapter 4) recounted how a visit to Birdworld,[19] following the birth of his first child, was a wakeup call for him to reduce his impact for the sake of his child's future.

Ideally focus groups should be run until ideas saturation is reached and no new ideas or concepts are forthcoming from the last focus group, however this is not necessarily a requirement (Rabiee 2004) . In this instance there were not enough volunteers to run enough focus groups to quite reach saturation with two new ideas arising during the final group. Nevertheless the main findings expressed here were raised in more than one group and by more than one participant in each. The results are indicative of the

[19] Birdworld, Farnham, Surrey. http://birdworld.co.uk/

beliefs and emotional connections of the participants but cannot necessarily be projected to the membership as a whole (Beyea and Nicoll 2000).

There were no negative responses to any questions of the questions posed on Facebook reflecting the positive bias in this audience and the potential lack of engagement with those of a differing opinion (the so called “echo chamber” effect). To truly engage in useful discourse using social media a dialogue is required, potentially with a ‘devil’s advocate’, to raise difficult issues for discussion.

Chapter 6: Effectiveness of an attraction's formal education programme

Abstract

Creating learning opportunities and delivering effective learning for children are of significant importance for educational visitor attractions. Delivery of effective conservation education is a common theme in the mission statements of these types of attraction and yet the means of evaluating success is varied and unclear. For many attractions, evaluation is done in terms of meeting the teacher's or school's requirements, but in order to demonstrate learning is taking place on a school visit a more in depth evaluation is needed. This evaluation needs not only determine the degree of learning of the subject matter being taught, but also examine attitude or perception change in schoolchildren following a visit. In this case study of a large zoo in Hampshire, a multimodal evaluation method is used to examine whether learning took place on school visits by children in key stages 1 & 2 (aged 5 - 12) and whether the children's ideas of what zoos were for changed following the visit. Participating children included more detail in animal drawings following their visit and the number of misconceptions they held fell. Taught sessions were found to be more effective at combating misconceptions than self guided visits. The children were also found to show an increased appreciation of the positive aspects of zoos (learning, conservation, having fun) and a decrease in negative associations (cages, captivity, making money). The study highlights the difficulty of establishing what can be small effects from a single visit to an attraction but demonstrates that changes in understanding can be achieved and demonstrated.

6.1 Introduction

In the data collection methods reported in chapters 2 to 5 the respondents were all adults, although their groups may have included children. Children are an important part of the audience to education based attractions, so in chapter 6 a combined drawing and survey exercise was devised for schoolchildren from key stages 1 - 2 (ages 5 - 12) visiting the case study location on formal school visits. The chapter examines what the children learnt from their visit, their changing understanding of the purpose of the zoo and the impact of a taught session from a member of the zoo education team as compared to a self guided visit lead by the class teachers.

Children are spending less time than ever before engaging with natural environments (Louv 2009; Ballouard *et al.* 2011; Larson *et al.* 2011; Atchley *et al.* 2012), which in turn means they are less likely to have positive environmental attitudes as adults (Lohr and Pearson-Mims 2005; Strife and Downey 2009; Keniger *et al.* 2013; Zuo *et al.* 2016b). Attractions such as aquaria, botanic gardens, museums and zoos have an opportunity to fill this gap as they are able to meet many of the criteria for direct contact with nature, novel learning environments and exploratory and experiential learning that have been shown to inspire children (Rickinson *et al.* 2004; Dillon *et al.* 2006; Lugg 2007; Bonderup Dohn 2011).

6.1.1 Learning outside of the classroom

Rickinson *et al.* (2004) found that learning outside the classroom had multiple benefits over traditional classroom sessions. Learning in new and novel surroundings aided long-term memory through the "memorable nature" of the setting, while the exploratory nature of the learning opportunities boosted both affective and cognitive learning and could lead to changes in both attitude and behaviour (Krepel and DuVall 1981; Hofstein and Rosenfeld 1996; Dillon *et al.* 2006; Bonderup Dohn 2011). The highly experiential nature of a school visit challenges the child to evaluative knowledge in new ways and can make a significant contribution to environmental sensitivity and emotional connectivity (Falk and Dierking 1997; Meredith *et al.* 1997; Lugg 2007). Memories are more likely to form and be reinforced where there are emotional and personal connections with the information being presented (Fivush and Sales 2004).

Learning is a sequential process that requires many exposures to the subject matter, in a variety of forms, to gain a proper understanding (DeMarie 2001; Farmer *et al.* 2007). The different types of experiences found when learning outside the classroom present

information in different ways, in both taught and exploratory situations, which increase knowledge and interest in a given subject and create greater motivation to learn more (Behrendt and Franklin 2014). Learning takes place differently, and cumulatively, in the differing contexts (James and Bixler 2008).

Institutions offering this type of learning have only limited contact time available when hosting a school visit allowing only a few key details to be conveyed in a taught session. Falk and Dierking (1997), Anderson *et al.* (2000) and Rennie and Johnston (2004) all argue, however, that learning will continue long after the day of visit. Information gained during a visit is integrated into existing knowledge and existing knowledge is re-evaluated, modified or discarded in the light of new information received (Dierking 1991; Anderson *et al.* 2003; Skidmore 2003).

To maximise the efficacy of a single visit an institution needs to be aware of the likely level of pre-knowledge of the individuals. Facilitating connections between new experience and previous knowledge will more likely result in learning than wholly new experiences (Tunnicliffe *et al.* 1997; Piscitelli and Anderson 2001). Previous learning from the classroom takes on new relevance and meaning when explored in person (Lei 2010a) hence, to maximise the impact of new experiences, there needs to be prior classroom learning to connect with (Lei 2010b). If the new knowledge is of too advanced a level the child may be unable to connect to existing knowledge and learning is less likely to occur. Completely new information, however well presented or interactive, is less likely to be remembered than something that can be related to previous, personal experience (Piscitelli and Anderson 2001).

6.1.2 The role of education in zoos

Of the 30 million visitors to zoos and aquaria in the UK each year, 1 million are on an organised educational visit through school or college (BIAZA 2014). This should provide these institutions with a unique opportunity to inspire the next generation to maintain and improve biodiversity around the globe (Fraser and Sickler 2008; BIAZA 2009a; BIAZA 2011a) although there is some debate about actual achievement against this goal (Moss and Esson 2013). Zoos are well positioned to inspire children in particular and expose them to nature in a variety of ways that television and online footage cannot with a close up, personal experience giving a full range of sensory input (Miller *et al.* 2004). Children learn different things from exploring a natural environment (e.g. nature centre) than from an animal encounter session as might be held in a zoo education session (Kimble 2014). Many zoos have the opportunity to offer both

experiences through exploration trails within the zoo and animal encounters in taught sessions, so wider learning objectives can be met in addition to those of the specific session taught. The education review performed at the end of the International Year for Biodiversity (Kimble 2011) concluded that it was important that organisations such as zoos facilitated real experiences for children where they can appreciate the importance of biodiversity first hand. The opportunity for close contact and direct observation gives zoos an advantage over classroom based learning or information gathering online (Sherwood *et al.* 1989; Randler *et al.* 2012; Kimble 2014) and a mixed programme of encounter and exploration maximises the opportunities available in this environment that may not be available elsewhere.

The majority of larger UK zoos have some form of formal education programme for school children of various ages which are aligned with the national curriculum (Patrick *et al.* 2007; BIAZA 2009a). Beyond the UK, the European Association of Zoos and Aquaria (EAZA) also puts a strong emphasis on education through a conservation education mission with a stated aim:

> To mitigate the extinction of biodiversity through quality conservation education that raises awareness, connects people to nature and encourages sustainable behaviours in the millions of people that engage with EAZA zoos and aquariums annually (EAZA 2016, p2)

To have any hope of achieving this aim, an education programme, whether targeted at children or adults, needs to reinforce attitudes that promote conservation and challenge beliefs or values that have a negative impact (WAZA 2005; Dove and Byrne 2014). The education programmes need not only provide factual information, but should also engage both children and adults in conservation of biodiversity (Kimble 2014; Ballantyne and Packer 2016) and promote lifelong learning (WAZA 2005; BIAZA 2009a). Developing the ability to learn, and motivating the child to want to explore further and learn more is at the heart of modern education (Glaser and Baxter 2000; Skidmore 2003) and is also fundamental and necessary aspect of zoo education (Braund and Reiss 2006; BIAZA 2011a; EAZA 2016).

In order for children to engage in positive environmental actions in the future, the living world had to have been of some ‘personal worth’ to them during their formative years (Lohr and Pearson-Mims 2005; Nancy and Kristi 2006). Close contact with artefacts and live animals greatly enhances the learning experience (Falk *et al.* 1986; Meredith *et al.* 1997) and can therefore form a key component of developing the emotional

connections and personal worth that promote further learning and engagement (Fivush and Sales 2004; Lugg 2007; Kimble 2014). The time spent connecting or engaging with nature instils a positive environmental attitude as well as improving the child's wellbeing (Tim 2014).

Bonawitz *et al.* (2011) note that while instruction is effective at communicating the target information, it also restricts exploration and learning of associated information and so places limits on learning which are not present in exploration. Conversely completely free learning has also been found to be ineffective in conveying information as with no focus attention moves too rapidly for learning to occur (Krombaß and Harms 2008). For free learning and exploration to be successful the child needs to have the necessary skills and processing capacity to be able to integrate new information into existing knowledge (Mayer 2004). In younger children, where these skills have yet to develop a guide or teacher can greatly assist with the construction of new meaning by helping to form the necessary connections with previous learning which may not be self evident (Skidmore 2003). Tunnicliffe *et al.* (1997) noted that self guided or class teacher led school visits were experience rich but were no more information rich than visits with parents and children who discussed what they were looking at between themselves and hence did not necessarily lead to greater learning. The guide therefore needs to be knowledgeable in the subject matter to make maximise learning opportunities (Hardy *et al.* 2006; Kirschner *et al.* 2006).

6.1.3 Evaluation of zoo education programmes and learning

Organisations that are members of national or international zoo associations are required to evaluate the effectiveness of their education programmes, and preferably evaluate them in regards to their contribution to conservation outcomes, not just their effectiveness at teaching subject matter (BIAZA 2009a; EAZA 2016). This is a very ambitious aim hence a robust evaluation methodology will be needed to determine if the institution is effective in delivering against this mission and if they are effective at reaching both adults and children (Miller *et al.* 2004).

Many conservation organisations either do no evaluation of education programmes, or do only simple evaluation of specific activities rather than evaluation covering all programme objectives (Carleton-Hug and Hug 2010). There is a temptation to measure the things that are easily quantifiable and to ignore qualitative aspects of learning that are harder to measure (Esson and Moss 2013). Evaluation is frequently done through teacher feedback on the taught session rather than the experience of the children

undergoing the learning experience and hence the evaluation of actual learning and impact of zoo education is lacking (Cox-Petersen *et al.* 2003; Fraser and Sickler 2009). Learning away from the classroom setting in zoos and museums is a very different experience to in-school learning and therefore needs to be evaluated in a different way (Meredith *et al.* 1997). Esson and Moss (2013) suggest that non-quantitative evaluation can fill this void and should be used alongside other methods to give a clearer overall picture of the zoo education experience.

For institutions such as zoos, contact time may be as short as a single visit lasting just a few hours so the evaluation method used needs to be able to separate out the effect of this single event (Bitgood 1989). Simple pre and post session tests of facts learned may give a snapshot of remembered information but are likely to miss deeper learning and the emotional connections needed to stimulate change in attitude (Bevins and Bitgood 1989). The assessment needs to test 'deeper understanding' rather than just content knowledge and that new knowledge has been integrated into existing constructs (Glaser and Baxter 2000).

Many evaluation methods are too focussed on the subject matter of the taught session and do not necessarily examine wider opportunities for learning that arise in a free-choice learning environment such as a zoo (Fien *et al.* 2001; Moss and Esson 2013). A focussed education session may teach about a particular topic without addressing the wider issue of conservation objectives (Kellert *et al.* 1996). The unplanned learning opportunities of the whole visit, including free exploration time and teacher lead discussion, may be greater than the individual taught session (James and Bixler 2008). The evaluation therefore needs to encompass the whole visit and examine the wider objectives of increasing awareness of conservation value and reducing biodiversity loss (Lundmark 2002; Miller *et al.* 2004) that the child may experience in a variety of settings throughout the visit.

Various authors have also called for greater focus on individual learning rather than aggregated learning across a whole programme. Learning is both personal and contextual so different children will learn different things in any given situation (Rennie and Johnston 2004) and any evaluation needs to allow room for these differences in what individual children may have learned. Wagoner and Jensen (2014) criticised many evaluation studies for aggregating all participants and looking at average results for the whole group. An “average” result does not represent any individual so does not tell the whole story of how individuals respond to the intervention. An average result

may hide any individuals who show a reduction in existing knowledge through confusion or misunderstanding (Moss and Esson 2013).

Some recent studies have attempted to develop methods to both examine more detailed learning outcomes and to examine learning over time. Miglietta *et al.* (2008) used a simple survey test to examine children's knowledge and retention of knowledge over time of sharks following a visit to an aquarium. The same test was administered immediately before, directly after and 3 months after visiting a new shark exhibit. They found information was retained following the visit but that there was a gradual reduction in the amount of information retained over time with the youngest children showing the largest reduction.

Young children are not necessarily good at expressing what they want to say in words and in the early stages of developing reading and language skills surveys need to be as simple as possible and use methods other than questions and answer (Borgers *et al.* 2000). Questioning them directly about learning or their experience may not gain an accurate picture of their learning so an alternative means of investigating their experience is needed (Hudson, Fivush, & Kuebli, 1992; Nelson, 1997).

To allow for a wider range of responses Leach (2011) used a 'journal' style writing exercise to encourage students recollection of a visit to an historic house. This free-expression method gave the children freedom to express what they remembered and the context in which they remembered it rather than restricting them to questions which may constrain or influence their answers. The downside of this method was that the sample size was necessarily small, however it was possible demonstrate a significant recollection of the visit including historical learning in 95% of participants.

While storytelling and journal writing techniques may be effective in allowing free expression of children’s experiences, it is limited to children old enough to have sufficient writing skill to express what they want to convey. For younger children, with more limited vocabulary and writing skills, some success has been seen by asking the children to draw pictures of what they remember (White and Gunstone 1992; Shepardson *et al.* 2007; Wagoner and Jensen 2010; Ozsoy 2012).

A study done at London Zoo evaluated children in key stages 2 - 4 before and after a taught session through their drawings of animals (Jensen 2010; Wagoner and Jensen 2010). The study showed that more children increased rather than decreased in drawing accuracy and detail after the session. The drawings were done immediately before and after the taught session so while this was a good measure of what the child

learnt from the session, it did not necessarily address the issues of deeper learning and connection to previous knowledge. Evidence of delayed recall is critical to demonstrating learning of subject matter rather than just memory of the day out (Nadelson and Jordan 2012).

For this study, a mixed method survey design was therefore developed to test for changes in young children's knowledge about animals following a school trip to the zoo. The study aimed to determine whether learning was taking place in the children and whether the way they felt about zoos changed following an education visit.

6.2 Case Study: Marwell Zoo

Nearly 40,000 schoolchildren visit Marwell Zoo in Hampshire each year on organised school visits. Of these, slightly over half attend a formal taught session as part of their day with the remainder taking in part in self guided visits (Marwell Wildlife 2016).

An evaluation of learning based on the drawing concept used at London Zoo (Jensen 2010; Wagoner and Jensen 2010) was designed for schools attending both taught sessions and on self-guided visit at Marwell Wildlife in Hampshire, UK. At Marwell the majority of school groups are in key stages 1 & 2 so the methodology was adapted to take account of the younger age group. The evaluation exercises were carried out in school a week before the visit and a week after to capture evidence of longer-term learning.

6.2.1 Method

A drawing exercise was devised whereby children were asked to draw and label their favourite animal in its habitat, allowing them complete freedom to choose any animal, hopefully one they were familiar enough with to produce a recognisable drawing. A similar approach was also used by Kimble (2013). The children were asked to label their drawing and space was left at the bottom of the page where they could add a description (Appendix 6:1). Some example habitats were given as a prompt for the children.

The second part of the survey asked the children to suggest what words they associate with zoos with space for up to five responses. On the pre-visit survey the children were asked to list words that they associated with zoos generally so as not to exclude children who had not been to Marwell Zoo. On the post visit survey the children were asked to list words that they associated with Marwell Zoo specifically. This was

intended to elucidate both a change in attitude towards zoos and gain an understanding of how the children felt about Marwell Zoo specifically.

Finally the children were presented with a list of twelve words or short statements representing a range of zoo related issues. Some of these related to positive messaging to do with the mission of zoos, some represented the zoo as a day out attraction and one suggested a negative connotation, that the zoo was only there to make money. On the pre and post visit forms the children were asked to circle the words that they thought best related to Marwell Wildlife. The lists of words were reordered randomly so that different children saw the words in a different order.

Schools booking zoo visits over the spring and summer terms in 2012 were invited to take part in the evaluation. The schools had booked either a zoo visit with 45 minute taught session or a completely self guided tour.

The pre-visit forms were sent to the schools approximately 2 – 3 weeks before their visit with instructions to conduct the pre visit evaluation as a whole class exercise approximately one week before the zoo visit. The post visit forms were given to the lead teacher on the day of the visit and again they were instructed to conduct the class exercise approximately one week after the visit. It was intended that this delay would allow the immediate impact and memory of specific animals to fade although the author acknowledges that this period was not long enough to properly test for information retention over time (Miglietta *et al.* 2008; Carleton-Hug and Hug 2010).

In total, 1109 children in Key Stages 1 & 2 from 25 schools took part in the exercise. The age of the children ranged from 5 to 12.

6.3 Analysis

The drawings exercise was designed to assess the level of knowledge the children had about animals and their habitats before and after a visit to the zoo rather than assess the drawing ability of individual children which was likely to be fairly simplistic with children of this age. It was therefore necessary to devise a scoring method that assessed the content and detail of the drawings and not the skill with which they had been done. The mechanism was designed to show the difference in drawing content regardless of actual drawing ability; hence any increase or decrease in detail would be captured equally for good drawers and bad. A scoring guide was devised for all scorers to follow to ensure consistency (Appendix 6:2). Any variation in scoring between different scorers should not affect the overall result as comparisons were between

before and after drawings and not between different children. To check for unconscious bias on the part of the scorers, approximately a quarter of the drawings (271) were assessed without knowing which drawing was before or after. Although a significant difference was found between the four scorers, those from the scorer who was not aware which was before or after was either in the middle of the range or showed the most positive results. Any error introduced by the scorers therefore is more likely to result in a type II, false negative error rather than a type I, false positive error.

The content of the drawings varied widely hence the scoring mechanism spilt up different elements of the drawing, again preventing the more detailed drawings skewing the results. The scoring was assessed separately for the details shown of the animal, in the habitat, and in the description or labelling of the drawing. Before and after differences were analysed using the Wilcoxon signed rank test. Although approximately normally distributed, variances of different groups were not equal and some showed significant skew. To determine the most likely cause of any differences found a Boosted Regression Tree (BRT) model was created. This modern robust method from machine learning makes very few assumptions about the data (Hastie *et al.* 2009) and is therefore better suited to this situation with wide range of variable types and interactions. This technique fits many decision tree models and combines the most appropriate to arrive at the best predictive model possible from the data available. The specific model used here was a Gaussian boosted regression tree (BRT) model, fitted using the R package gbm 2.1.1 (Ridgeway 2015) and the extra routines supplied by Elith *et al.* (2008). The maximum number of trees was set to 10,000, bag fraction = 0.5, tree complexity 5 and learning rate 0.001. Ten-fold cross-validation optimisation of the model was performed using Elith *et al.'s* (2008) step.gbm routine.

As well as scoring the drawings based on the details shown they were also assessed on a number of dichotomous before and after comparisons. These were: whether the children drew a Marwell animal, whether they included habitat or text in the drawing and whether the habitat was appropriate to the animal. The size of the effect and significance was measured using McNemar's chi square for dichotomous data and the odds ratio for likelihood of positive or negative change.

The unstructured free answer statements of what the child thought about zoos or Marwell were grouped into categories of similar words expressing common themes or emotions and the number of occurrences of those words analysed using paired t-test. The number of children using the different categories or types of words were also

counted and compared before and after the visit using McNemar's chi square and the odds ratio.

The words circled for ‘what is Marwell Wildlife for’ were also dichotomous before and after comparisons so were analysed using McNemar's Chi square.

6.4 Results

6.4.1 Animal drawing detail

Fifty-one percent of children (545/1064) showed no change in the amount of detail seen in their drawing. Of the remaining children 27% showed an increase in drawing detail and 21% showed a decrease (292 vs 227). Improvements were seen in body shape and in the inclusion of more morphological details such as colour, markings, claws, horns or a mane (Figure 6-1). This difference was significant but the effect size was small reflecting the large number children who showed no difference (Table 6-1).

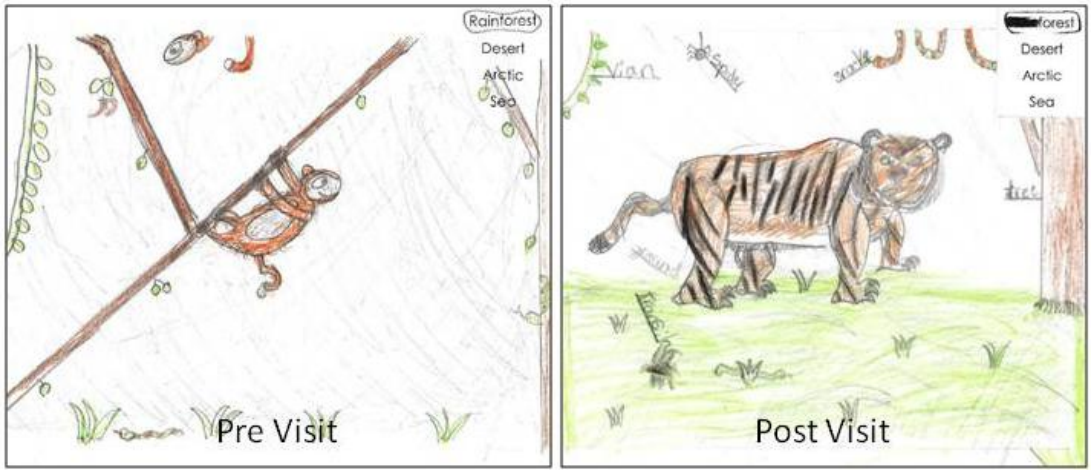


Figure 6-1. Increased detail in animal drawing post visit. Male age 7.

6.4.2 Habitat drawing detail.

Not all children included habitat in both their drawings. Of the 769 children who drew habitat in both their before and after drawings. 61% of these showed no change in the amount of detail included in the habitat drawn (469/769). In this case the percentage showing an increase in detail after the visit (17%, 130) was smaller than the percentage showing a decrease in detail (22%, 170). As before, this difference was found to be significant but the effect size was very small due to the large number of children who showed no difference (Table 6-1). The reduction in accurate drawing detail in habitat was strongly affected by the number of children drawing enclosures

after their visit. The children were asked to draw their favourite wild animal with the plants and animals that live with it in the wild. An enclosure drawing, therefore, was scored as zero for accuracy and hence suggested a decrease in accuracy when all the scores are combined. When the data were reanalysed including only those children who drew a natural habitat (whether correct or not) both before and after, and excluding those who drew enclosures, there was no significant difference in the amount of detail in the habitat drawings (Table 6-1).

6.4.3 Text and labelling accuracy

There was more variation in the amount of detail in drawing descriptions and labelling than in the drawings themselves. Of the 794 children who included labelling or a description on their drawings both before and after the visit only 43% showed no change (Table 6-1). The number of children who showed an increase in detail was almost the same as the number who showed a decrease, hence the difference in the number of accurate text details before and after the visit was not significant.

6.4.4 Boosted Regression Tree Model

The BRT analysis found that which school a child attended was the single most significant factor in determining whether a drawing included more or less detail following the visit. This factor was responsible for 60 - 68% of the variation shown in drawing detail for the animal, the habitat and the description. Overall, however, the model was only able to predict around 10% of the total variance indicating there are many causes of variation between individuals that are not accounted for by the model.

6.4.5 Number of misconceptions in drawings and text

The majority of children (760) did not show any misconceptions about either animals or habitats before or after the visit. Of those who did show at least one misconception about animal or habitat, more showed a decrease in the number of misconceptions than showed an increase (176 vs 101,Table 6-1). This result was significant and is the largest effect seen from analysis of the drawing and text detail. There was a small but significant difference in the change in number of misconceptions made between those who attended a taught session and those who had a self-guided visit. Those who had attended a taught session showed a larger reduction in the number of misconceptions on their drawings than those who did not ($z = 2.537$, $p < 0.05$, $r = 0.08$). In both cases the median change in number of misconceptions was zero due to the large proportion

of children in both groups who showed no change (taught session 77%, self guided 80%).

The most common types of misconceptions, both before and after the visit, were in identifying the correct habitat and diet for the animal drawn. Common habitat mistakes were drawing penguins in arctic habitats with polar bears and igloos and savannah animals such as lions and giraffe in rainforests. Penguins were depicted in the arctic with igloos and / or polar bears in 37% of penguin drawings before the visit but in only 15% of penguin drawings afterwards (Figure 6-2). Lions were depicted in 'jungle' with tall trees and vines in 26% of the lion drawings before the visit but in only 17% of the lion drawings afterwards. Common dietary mistakes were carnivores (lions and tigers) eating plants and monkeys eating bananas (very few species of monkey live in areas or habitats where bananas grow naturally). Overall instances of incorrect habitat fell by 36% after the visit and incorrect diet fell by 56%.

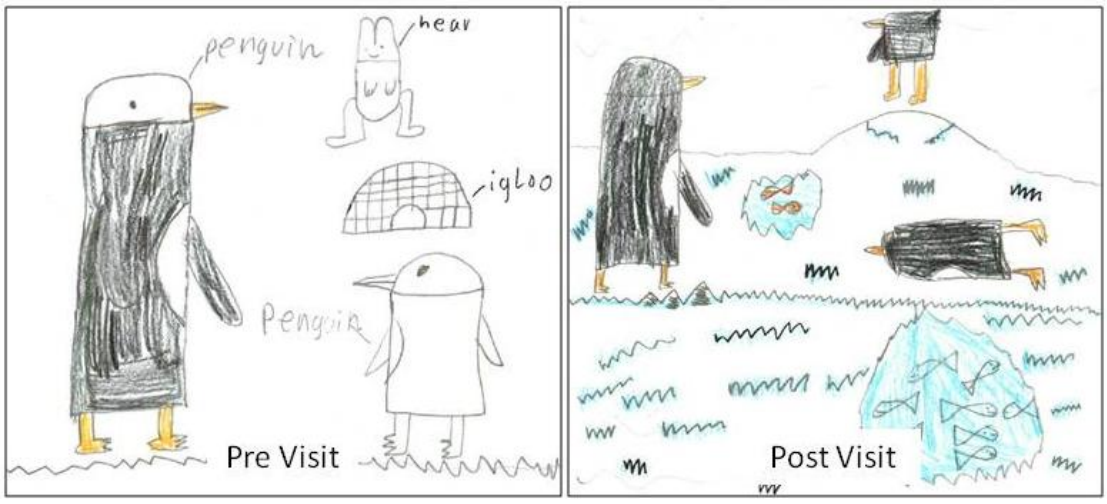


Figure 6-2. Correction of misconception post visit. Male aged 8

Not all misconceptions reduced following the visit. Before the visit 24 children drew their animals living in buildings of which one was recognisably in a zoo. After the visit this increased to 74, all of which were animals which could be seen at Marwell drawn in surroundings that appeared to be enclosures with features such as fences, buildings, feeding troughs or people looking at the animals (Figure 6-3).

Figure 6-3. Drawing of enclosure after visit. Female aged 7

Table 6-1.Scoring results for drawing detail and misconceptions. * significant at p < 0.05 or better

	Number with no change	Number showing increase	Number showing decrease	Wilcoxon signed rank test		
				z	p	r
Animal drawing details	545	292	227	2.308	<0.05*	0.05
Habitat drawing details	469	130	170	2.984	<0.01*	0.08
Habitat drawing details excluding enclosures	459	130	121	0.677	0.499	0.02
Text details	345	221	228	0.627	0.531	0.02
Misconceptions	806[20]	101	176	4.719	<0.001*	0.1

6.4.6 Dichotomous comparisons of drawings and text

Around a quarter of participating children were found not to have included habitat or text in their drawings both before and after the visit. The drawings were therefore also analysed based on what they had decided to include or leave out of their drawings. In particular: had their choice of "favourite animal" changed; were they more likely to include habitat after the visit; was that habitat more likely to be appropriate for the animal drawn and were they more likely to include text after the visit.

[20] 760 children showed no misconceptions either before or after their visit and 46 made the same number of misconceptions before and after their visit.

6.4.6.1 Did the children draw animals that could be seen at Marwell?

The number of children who chose to draw an animal that can be seen at Marwell was significantly larger after the visit than before (Table 6-2). Not all changes were positive however and some children who had drawn animals that could be seen at Marwell before the visit chose not to afterwards and vice versa. The proportion that made a positive change (332/464) was significantly larger than the proportion that made a negative change (89/596, Table 6-2) indicating the children were much more likely to change to drawing a Marwell animal after the visit than not.

6.4.6.2 Was habitat included?

Not all children included habitat in their drawings and not all included habitat both before and after their visit. There was a small drop in the number of children who included habitat in their drawings after the visit. This drop was found to be significant although the effect size was quite small. As with the animal drawings, however, both positive and negative changes were seen. The proportion that made a positive change (86/176) was significantly larger than the proportion that made a negative change (118/889) indicating that a child who had not included habitat before the visit was more likely to then draw habitat afterwards than one who had drawn habitat before changing to not drawing habitat afterwards (Table 6-2).

6.4.6.3 Was the habitat drawn appropriate?

Of the children who did include habitat in their drawings it was not always appropriate for the animals drawn. There was a small, but significant, drop in the number of children who drew appropriate habitat after the visit. As with the drawing detail scoring above (6.4.2) the appropriateness of the habitat drawn was strongly influenced by the drawing of enclosures after the visit. If those children who drew enclosures after the visit were removed from the analysis, there was then no significant difference in the number of children who drew appropriate habitat before and after the visit.

The proportion that made a positive change (45/59) was significantly larger than the proportion that made a negative change (37/652) indicating a child who drew inappropriate habitat before the visit was much more likely to then draw appropriate habitat afterwards than one who had drawn appropriate habitat before changing to drawing inappropriate habitat afterwards (Table 6-2).

6.4.6.4 Did the children include text and labelling on their drawing?

Not all children included text with their drawings and not all included text both before and after their visit. There was a significant drop in the number of children who included text with their drawings after the visit. The proportion that made a positive change (61/137), however, was significantly larger than the proportion that made a negative change (150/944) indicating that although there was a drop in the total number of children who included text, it was more likely that a child who had not included some text before the visit would then include some afterwards than it was for one who had included text before to then not include some afterwards (Table 6-2).

Table 6-2. Dichotomous comparisons of drawing content. * significant at p < 0.05 or better

	Number before	Number after	n	McNemar's X^2	p	Proportion making positive change	Proportion making negative change	Odds ratio	Odds ratio 0.95 CI	z	p
Was drawing of an animal that could be seen at Marwell Zoo	596	839	1060	139.11	< 0.001*	72%	15%	14.33	10.59 - 19.38	17.26	<0.001*
Did drawing include habitat	889	873	1065	4.711	< 0.05*	49%	13%	6.24	4.38 - 8.89	10.16	<0.001*
Was the habitat appropriate to the animal drawn	701	660	769	12.214	< 0.001*	66%	12%	13.99	8.07 - 24.27	9.39	<0.001*
Was the habitat appropriate to the animal drawn - excluding enclosures	652	660	711	0.598	0.440	76%	6%	53.43	26.92 - 106.03	11.38	<0.001*
Did the child include text	944	855	1081	36.701	< 0.001*	45%	16%	4.25	2.91 - 6.21	7.47	<0.001*

6.4.7 Free choice of descriptive words

After the visit there was a significant increase in the number of times words were used that expressed ‘wonder’, ‘fun & excitement’, ‘learning’ and ‘conservation’ and in the number of children using these words (Table 6-3). There was a significant decrease in the number of times animals were named that cannot be seen at Marwell and in the number of children naming animals. There was a significant increase in the number of times animals were named that can be seen at Marwell despite a slight fall in the number of children naming these animals. The small drop in the number of children naming animals that can be seen at Marwell was found not to be significant.
There was also a significant decrease in the number of words used that indicated a negative impression of zoos following the visit and in the number of children using these words.

The proportion of children who make positive or negative changes tells a slightly different story (Table 6-4). The proportion making a negative change from using a particular type of word before the visit to not using it afterwards was significantly larger than the proportion making a positive change for words expressing ‘wonder, ‘learning’ and ‘conservation’. Only words expressing ‘fun & excitement’ showed a larger proportion making a positive change than negative.

The proportion of children who stopped using words indicating a negative impression of zoos was significantly larger than the proportion that did use these words after the visit.

Table 6-3. Number of time different types of words were used in the free answer section. * significant at p < 0.05 or better

Word category	Number of times this word type is used to describe zoos pre-visit	Number of times this word type is used to describe Marwell post-visit	Change	t	df	p
Words indicating wonder (e.g. amazing, beautiful, fantastic, spectacular, wonderful)	130	240	85%	5.500	1009	<0.001*
Words indicating fun and excitement (e.g. cool, entertaining, exciting, happy, scary, terrific)	935	1257	34%	7.560	1009	<0.001*
Words associated with learning (e.g. discovery, educational, exploring, interesting)	232	415	79%	7.377	1009	<0.001*
Words referring to conservation activity (e.g. caring, endangered, helping, protecting, rescue)	80	163	104%	5.721	1009	<0.001*
Specific animals named that can be seen at Marwell	685	821	20%	3.015	1009	<0.01*
Specific animals named that cannot be seen at Marwell	322	126	-61%	9.074	1009	<0.001*
Words showing a negative impression (e.g. bars, cage, captivity, cruel)	189	111	-59%	5.415	1009	<0.001*

Table 6-4. Changes in the number and proportion of children using different types of words in the free answer section. n=1010. * significant at p < 0.05 or better

	Number before	Number after	McNemar's X^2	p	Proportion making positive change[21]	Proportion making negative change[22]	Odds ratio	Odds ratio 0.95 CI	z	p
Words indicating wonder (e.g. amazing, beautiful, fantastic, spectacular, wonderful)	96	164	27.710	<0.001*	13%	49%	6.66	4.27 - 10.40	8.35	<0.001*
Words expressing fun and excitement (e.g. cool, entertaining, exciting, terrific)	498	602	32.543	<0.001*	42%	22%	2.52	1.92 - 3.32	6.61	<0.001*
Words associated with learning (e.g. discovery, educational, exploring, interesting)	134	239	45.637	<0.001*	20%	49%	4.00	2.74 - 5.84	7.20	<0.001*
Words referring to conservation activity (e.g. endangered, helping, protecting, rescue)	69	129	25.225	<0.001*	11%	57%	11.06	6.58 - 18.59	9.07	<0.001*
Specific animals named that can be seen at Marwell	345	322	1.869	0.172	18%	42%	3.20	2.39 - 4.29	7.80	<0.001*
Specific animals named that cannot be seen at Marwell	238	103	78.410	<0.001*	6%	76%	50.13	32.93 - 76.33	18.25	<0.001*
Words showing a negative impression (e.g. cage, captivity, cruel)	132	64	31.174	<0.001*	4%	80%	90.12	52.61 - 154.37	16.39	<0.001*

[21] A positive change is a change from not including a word in each category before the visit to then including a word from that category after the visit. In this context a positive change in the final two categories, e.g. an increase in the number of children using negative words, would be considered a poor outcome

[22] A negative change is a change from including a word in each category before the visit to then not including a word from that category after the visit. In this context a negative change in the final two categories, e.g. a decrease in the number of children using negative words, would be considered a measure of success

6.4.8 Choice of circled words

There was no significant difference before and after the visit in the number of children who circled Conservation, Days out, Fun, Looking after animals, Making money, Playing, Seeing animals or Sustainable (Table 6-5).

There were significant increases in the number of children who circled the positive terms Environment and Learning and significant decreases in the number of children who circled terms relating to the augmented product activities Eating and Ice cream.

Looking after animals and seeing animals were the most popular responses before the visit and remained among the most popular afterwards only exceeded by the increase in the number of children who thought Marwell was about learning.

Table 6-5. Changes in words circled in the word list section. n = 1047. * significant at p < 0.05 or better

	Number before	Number after	McNemar's X^2	p	Proportion making positive change	Proportion making negative change	Odds ratio	Odds ratio 0.95 CI	z	p
Conservation	370	402	2.951	0.086	28%	44%	2.04	1.56 - 2.66	5.22	<0.001*
Days out	596	634	2.369	0.124	39%	26%	1.83	1.14 - 2.39	4.52	<0.001*
Eating	228	189	6.261	0.012*	10%	54%	10.38	7.35 - 14.67	13.28	<0.001*
Environment	454	503	5.297	0.021*	31%	33%	1.06	0.82 - 1.38	0.47	0.642
Fun	742	754	0.420	0.517	47%	19%	3.71	2.78 - 4.94	8.96	<0.001*
Ice Cream	182	114	27.562	<0.001*	5%	59%	30.0	19.38 - 46.45	15.257	<0.001*
Learning	738	902	13.01	<0.001*	54%	15%	6.54	4.86 - 8.82	12.37	<0.001*
Looking after animals	882	817	0.039	0.843	64%	13%	12.01	8.36 - 17.27	13.43	<0.001*
Making Money	250	235	1.004	0.316	13%	49%	6.50	4.70 - 9.00	11.30	<0.001*
Playing	290	310	1.826	0.177	19%	43%	3.22	2.39 - 4.33	7.70	<0.001*
Seeing Animals	821	859	2.259	0.133	57%	14%	8.05	5.84 - 11.11	12.72	<0.001*
Sustainable	206	238	3.027	0.082	17%	57%	6.35	4.56 - 8.84	10.97	<0.001*

6.5 Discussion

This case study set out to determine if educational visits to Marwell Zoo had a measurable impact on the children who attended them. The study posed two questions:

- Did the children show a measureable increase in their knowledge of animals and their habitats as measured by the detail included in drawings?
- Did the children show a measurable change in their attitude towards zoos and their purpose as measured by their free answer comments about zoos and words they chose to associate with zoos?

6.5.1 Drawings

Overall the drawings indicate the zoo visit had a measurable positive effect on around a fifth to a quarter of the participating children. The number including additional detail after the visit was larger than the number who included less detail (292 vs 227). Typical improvements included adding the correct markings or colouring and adding distinguishing features such as horns or a mane. The children including these additional details may be including something new that they have learnt or the visit may have refreshed or reinforced an existing memory contributing to their overall understanding of the animal in question.

No discernible change in drawing detail or labelling was seen for around half of the children taking part and the number showing increased detail was only slightly larger than those showing a decrease in detail so although the result was positive the effect was quite small.

The improvement was seen in the drawings of animals but not in the habitat drawn or in the text used to describe the drawings. This agrees with DeMarie's suggestion that young children will be focussed on animals, and familiar animals in particular, rather than novel concepts which may surround them (DeMarie 2001).

Although overall fewer children included habitat in their drawings after the visit, those who had not done so before the visit were significantly more likely to include some afterwards. This may have been as a result of learning specifically about the habitat of the animal they have drawn or it may be a result of a wider awareness of different habitat types generally. The same was true of labelling of drawings with those not

including text prior to the visit being inspired to include text and labelling on their drawing afterwards.

A key indication of learning in the children was the change in the number of misconceptions seen in the drawings and text following the visit. Misconceptions around animals are common on television, cinema and in children's books with animals frequently stereotyped which can hamper children's learning about the natural world (Ganea *et al.* 2014; Neves and Monteiro 2014).

In the UK / Swiss children's cartoon series Pingu, for example, the penguins are referred to as 'living on the ice cap' and are depicted living in igloos (Mazzola 1995). The single most common misconception seen in the children's drawings before the visits was penguins shown in the arctic with igloos or polar bears. In this study over twice as many children drew penguins after the visit as before and the proportion depicting them incorrectly in arctic habitats fell by 22%. Similar reductions in the proportion of misconceptions for specific animals was found for lions in jungle, giraffe in forests and Snow Leopards in the arctic indicating the visit was successful in correcting these types of misconceptions.

In the children's books, and later cartoon series, Curious George, the eponymous character is a monkey who has frequently been depicted eating bananas since the books were first published in 1941(Houghton Mifflin Harcourt 2017). In this study, incorrect diet was seen in 57 drawings before the visit and 25 afterwards with monkeys with bananas appearing in 18 drawings before the visit and 8 afterwards. The number of monkeys drawn following the visit was fewer so the proportion of monkeys that were drawn with bananas only reduced by 3%. Although Marwell has several smaller monkey species they are perhaps not as prominently presented as the larger animals. In this instance it seems Marwell is successful in correcting some misconceptions around animal diet (Rhino hunting other animals for example) but less successful in tackling some commonly held stereotypes that are not specifically addressed.

In the children's animated stories of Peppa Pig (Astley Baker Davies 2009) a wide range of animals interact that would not meet in nature and these animals exhibit unlikely behaviours. Some of these are obviously fanciful (talking, walking upright, wearing clothes) and are unlikely to be confused with real behaviours in children in this age range (Sharon and Woolley 2004). Other depicted behaviours are less obviously wrong without some prior knowledge and could lead to confusion such as pigs, wolves and elephants interacting, or the tortoise character climbing trees. Incorrect

assemblages of animals was seen in 40 drawings before the visit and 30 afterwards suggesting the visit was only partially successful in correcting this type of misconception.

Attending a taught session with a zoo educator led to a greater reduction in the number of misconceptions the children held about animals and their habitats. This finding agrees with that of Mayer (2004), Hardy *et al.* (2006) and Kirschner *et al.* (2006) reflecting the greater depth of knowledge of the in house educators compared to the class teachers. Self exploration is an important part of the learning experience of a field trip (Sfard 1998; James and Bixler 2008) but completely unstructured exploration can have disappointing results, such as being unable to distinguish zoo habitat and behaviour from natural behaviours. Some form of structure and guidance is needed to focus exploration on the topic in question (Hmelo-Silver *et al.* 2007; Bamberger and Tal 2008; Davidson *et al.* 2009; Bonawitz *et al.* 2011). This does, however, require significant preparation on the part of the teacher to create the space and structure for learning and time for follow up discussion after the visit (Puchner *et al.* 2001; Rickinson *et al.* 2004; Dillon *et al.* 2006; Patrick *et al.* 2013; Behrendt and Franklin 2014). The guide therefore needs to be knowledgeable in the subject matter and experienced in teaching in free learning environments.

The class teacher is familiar to the children and knowledgeable about their individual learning styles and amount of pre-knowledge and hence should be the most appropriate person to guide learning (Kisiel 2013). Alon and Tal (2016) found that self reported learning was higher in students who believed their teachers were more involved in the field trip session, but Kisiel (2013) found there was confusion as to the role of the teacher on a visit to zoos who were not sure if they should be involved in sessions or should focus on logistics. de White and Jacobson (1994) found that students who's class teacher had attended workshops on wildlife conservation showed significant improvements in knowledge and attitude to wildlife. Which school a child attended had the largest effect upon the number of details included in drawings which may reflect the amount of preparation and personal knowledge the individual teacher was able to include. The difference seen here between attending a session and not confirms Skidmore’s finding that where the class teacher lacks the necessary knowledge or time, a specialist zoo educator may be able to fill the gap (Skidmore 2003).

Some of the misconceptions seen after the visit may be information the children have picked up but either not entirely understood or have associated with wrong animal. For

example, one child wrote on their snow leopard drawing that only 35 snow leopards were left in the wild. This statistic is presented in the park but refers to Amur Leopards (*Panthera pardus orientallis*) not Snow Leopards (*Panthera uncia*). This partially retained information can be considered a partial success in the constructivist model of learning. In this instance, the specific information had been attached to the wrong animal in long term memory. If the child later hears this information again they will compare it with their existing knowledge of Leopards and, hopefully, recognise the error and so correct their construct.

While the incidence of many of the misconceptions about habitat reduced after the visit, the number of animals living in buildings or enclosures increased. The visit appears to have introduced an element of confusion between an animal's natural habitat or behaviour and the habitat it lives in at the zoo.

All of the enclosures drawn after the visit were in drawings of animals that can be seen at Marwell and all but five were by children who had not drawn that animal prior to the visit. Marwell is a 'parkland' zoo with the majority of the large animals housed in large paddocks with grass and trees. While the enclosures are 'themed' to be evocative of the animal's natural habitat, the main effect is of English countryside and animal housing. The children may not genuinely believe that an animal's habitat is the zoo or enclosure but they may not have learnt what the animal's natural habitat is and so are drawing what they remember (Myers Jr *et al.* 2004). The child is not necessarily reproducing what they saw at the zoo but rather they are combining what they saw, read or were told with their existing knowledge gleaned from many sources (Anderson *et al.* 2003; Skidmore 2003; Leach 2011). At the zoo they may have read or been told, for example, that giraffes live on the savannah but they may well have only seen only a representation of what this looks like. The depiction of giraffe in their picture is a construct from a combination of information sources, including what they saw at the zoo. At this stage of their learning, they may appreciate which is the correct habitat but not necessarily what the details of that habitat look like (DeMarie 2001; Myers Jr *et al.* 2004).

Looking more broadly at what the children chose to draw rather than the accuracy of the drawings themselves reveals a clear influence of the visit to Marwell Zoo. More children drew animals they could have seen on their zoo visit afterwards (839 after compared with 596 before), with a greater proportion making positive change to drawing these types of animals. That they were able to remember what they saw around a week after the visit and reproduce it to some extent suggests the memory of

the event has been transferred to long-term memory. Many of these children will have an idea of the animals they have seen and drawn from books or television so the new information gained from seeing the animal in the flesh will have been integrated into their existing idea of what the animal looked like, hopefully improving their recognition and understanding of it.

6.5.2 Free answer words and word selection

The increase in the number of words used expressing fun and excitement following the visit (602 after compared to 498 before) indicates an increase in positive associations with the zoo visit. These positive associations between seeing animals and learning are important in successful learning (Leach 2011) and for forming the long lasting relationship with nature that will result in less damaging behaviour in later life (Strife and Downey 2009; Keniger *et al.* 2013; Tim 2014).

Overall the number of animals mentioned in the free answer section fell after the visit as the various positive words and phrases increased. The number of mentions of animals that can be seen at Marwell fell only very slightly while the reduction in the number of mentions of other animals was significant.

Prior to the visit there were a small number of the children who used words indicating a negative impression of zoos. The significant reduction in the number of children expressing negative opinions of zoos after the visit (132 before vs 64 after) is another indication of the positive impact of the visit and the increase in the positive association needed for meaningful connections and increased learning.

When asked to circle words they associate with zoos or with Marwell the number choosing ‘Learning’ increased significantly after the visit. In the free answer section, the total number of children using words associated with learning increased after the visit but the proportion who stopped using these words after the visit was significantly larger than those who did use them (49% vs 20%). This apparent contradiction may have come about because of the limited space available in the free answer section and the relative complexity of concepts such as ‘exploration’ and ‘learning’ compared to ‘fun’ and ‘exciting’. In the circle words section the children were presented with a list of concepts and were free to chose as many as they wanted that represent how they feel. Providing they understood the concepts this was fairly simple task. In the free section, however, imagination was required and space was limited so only the most pressing ideas were likely to be listed. Children stopping using these learning words does not necessarily mean that the child no longer believes the zoo is about learning, rather it

may simply indicate that other functions were more prominent in their memory of the visit.

The number of children who chose words associated with conservation in the free answer section or circled ‘Conservation’ increased slightly after the visit. In both cases, however, the proportion who stopped using or circling these words after the visit was significantly larger than those who did use them (57% vs 11% and 44% vs 28%). This would appear to confirm the idea that more than one session is needed to get complex issue such as conservation of biodiversity across to young children (Farrar and Goodman 1992; Farmer *et al.* 2007).

The number who chose ‘Looking after Animals’, ‘Seeing Animals’ and ‘Fun’ in the circle words section remained consistently high before and after the visit. The number circling peripheral activities such as ‘Eating’ and Ice Cream’ fell significantly after the visit, perhaps indicating increased awareness that a day at the zoo is not just a fun day out.

6.6 Conclusion

The findings above demonstrate that an educational visit to Marwell Zoo does influence the understanding and attitudes of children. The effect is subtle however and more work is needed to evaluate schools' visits to zoos within the context of the curriculum and wider learning objectives to understand better the impact and to focus attention on those programmes showing the greatest impact. The drawing exercise was able to show that it is possible to demonstrate a small but measurable impact before and after an educational visit to the zoo. In particular, the large increase in the number of animals drawn that could have been seen during the visit indicates that the visit was, at the very least, a memorable event. The accuracy of the drawings also increased slightly, despite the fact that around a third of children were drawing a new animal, further indicating that learning did take place during the visit. It is notable that there were both increases and decreases in drawing detail and the amount of text and labelling added suggesting the relationship between the visit and learning is not a simple one.

The experimental design used here was intended to show whether learning persisted beyond the day of the visit. Miglietta *et al.* (2008) found that cognitive learning was occurring during visits to an aquarium with students retaining information about the subject 3 months after a visit, although the amount of retained knowledge was less

after 3 months that it had been immediately following the visit. In this instance there was a small change in the details remembered by the children and also a change in the attitudes of the children, as determined by their free answer words and words or phrases they circled which persisted beyond the day of the visit.

Matiasek and Luebke (2014) stated that evaluation should be continual to be most effective. The type of evaluation exercise conducted here had only a short delay following the visit to allow short-term memories to fade. The exercise has the potential to help cement learning from the visit as a recall exercise as well as evaluating learning from the visit but to maximise this benefit, it would need to be more targeted towards specific learning goals than was attempted here. Repeating the exercise after a longer interval could reveal erosion of knowledge, as seen by Miglietta *et al.* (2008), or it may reveal a reinforcement and constructionist effect with knowledge from the visit combined with subsequent learning leading to greater detail many months later.

Jensen (2014) was also able to show that an educational visit to the zoo could have "pro-conservation and attitudinal impact". This case study did not attempt to measure actual behaviour change or contribution to conservation goals, as suggested by Fien *et al.* (2001) and others, but it was able to show a change in attitude towards zoos and a reduction in the number of misconceptions about animals. In this study we saw a slight reduction in the importance given to conservation compared to words associated with other key impacts such as learning.

One goal of zoo associations is for all zoos to evaluate their education programmes in terms of their contribution to organisational goals and mission rather than individual programme outcomes (BIAZA 2009b; EAZA 2016) but this a significant commitment for smaller institutions to achieve. The exercise as performed for this study was a significant undertaking. Recruiting the schools and setting up the evaluation sessions took around six months and scoring the resulting forms took 35 - 40 days over the following six months and hence would be difficult to replicate on an ongoing basis for all visits. If it were offered as a download for schools to undertake as a further learning exercise which they were able to score themselves, greater coverage and examination of longitudinal impacts may be possible. The scoring would need to be simplified however to avoid significant resource impacts and to ensure consistency across a large number of markers.

Various authors (Tunnicliffe *et al.* 1997; Piscitelli and Anderson 2001; Lei 2010b) note that learning is most effective when new information can be connected to prior knowledge. At Marwell, connection with prior learning is made by ensuring taught

sessions are aligned with the National Curriculum (Department for Education 2014) and by obtaining feedback from schools. Support materials are available for download from the Marwell website but while data on the number of downloads are available; it is not known how many teachers use these as pre-visit exercises. The review of learning following the International Year of Biodiversity 2010 (Kimble 2011) concluded that class teachers should be engaged earlier to allow time for more preparation before a visit. Pre-visit exercises or lessons and the use of these materials were not assessed in this evaluation. Including pre-visit preparation and post visit follow up in future evaluation could provide a much clearer picture of how well learning objectives are being met. Many schools bring children of different age groups to visit Marwell. One result of this is that many children will visit Marwell more than once between key stages 1 and 3. Repeating the same evaluation exercise with schools over many years could provide valuable longitudinal data on both curriculum learning goals and the development of attitudes towards conservation of biodiversity.

This study confirmed that zoos do have an impact on children attending for an educational visit but that evaluation conditions need to be controlled and the exercises repeated over time to obtain a clear impression of individual development.

Chapter 7: Discussion:

This study set out to investigate:

- Whether it was possible to track visitor spatial behaviour as they moved around a large visitor attraction and how their movement varied with different types or groups of visitors
- Whether visitors learnt on visits to attractions and how their spatial behaviour and group type affected their learning opportunities
- Whether visitor experiences at educational attractions inspired changes in behaviour that could contribute to reducing biodiversity loss
- Whether learning and willingness to change behaviour increased with repeated exposure over many visits
- Whether school children were learning on formal educational visits to attractions
- How an attraction could account for changes in visitor behaviour and compare these against negative impacts of operation to achieve a net positive position

7.1 Effective tracking of visitors' spatial movements

The use of handheld GPS devices proved to be an effective means of evaluating the movement of groups of visitors around the case study location. The method was able to resolve the majority of the larger exhibits within the park, although it was less effective inside buildings and in areas with several small exhibits close together. The main path effect seen by others (Deans *et al.* 1987, as reported in Bitgood (2006); Davey 2006b) was found to be a significant effect here with relatively few visitors moving away from the perceived main route.

The method was able to resolve differences in behaviour between different group types, with the presence of children and group size having a notable effect on where visitors spent their time. There was significant overlap between the most frequent visitors and members with both these factors contributing to where visitors spent their time and how long they stayed in the park. These regular visitors are likely to know their way around and have favourite animals that they visit and hence spend less time at areas of less interest to them, although this has not been tested at this stage.

The temporal variation in movements around the park throughout the day has been useful in planning since the work was completed. A new walkthrough lemur exhibit will be opening in summer 2017. This exhibit will be adjacent to the current Giraffe house

and from the GPS data it can be seen that the majority of visitors will arrive at this exhibit between 10:30am and 1:30pm. The data shows that on a busy day there could be 1,000 people per hour passing through the exhibit. Marwell can use this knowledge to plan appropriate numbers of staff for this area to manage any potential crowding issues. The exhibit also has an indoor area with interpretation panels and volunteer station. The GPS tracking was ineffective inside buildings, therefore a trial is being planned for this area utilising low resolution thermal imaging to record visitor dwell time at the various individual interpretation elements. It is hoped that this will complement the GPS data collected during this study and help to fill in the gaps in behaviour inside buildings.

7.2 Learning on visits to conservation attractions

As with many education-based attractions, providing learning opportunities is a significant part of Marwell's mission (Marwell Wildlife 2015). A large proportion of the visitors to Marwell Zoo believed their visit was a learning experience and that learning had been a motivator for choosing Marwell as a day out. A large proportion of the focus group members and Facebook responders also stated that learning opportunities were a driver for choosing where to go on a day out. Despite believing they learnt on their visit, however, only a relatively small number could remember details of something they had learnt. Unsurprisingly, those who stayed longest and spent the most amount of time at the animal exhibits were most likely to report learning from their visit. Although a longer visit could simply imply more time spent having lunch or at playgrounds, there was only a marginal drop in the proportion of the day spent attending to the animals with a longer visit. This confirmed that a longer visit does indeed result in more time spent at animal exhibits and hence more time is available to absorb messages from the various exhibits.

The visitor’s memory of their visit to Marwell was variable, with relatively low recall of messages and of where they spent their time. Short, factual messages from signs and talks were found to be most memorable. Engagement events, activities and interactive exhibits were also found to be memorable and were popular with the engaged individuals sampled in the focus groups and on Facebook. Creating memorable, interactive exhibits and experiences that are also fun to engage with is an important method of creating learning opportunities and sharing takeaway messages (Foster *et al.* 1988; Allen 2004; Falk and Storksdieck 2005; Packer 2006; Luebke and Matiasek 2013). In the Marwell example, in the time since the surveys were conducted the meet

the keeper and animal feed type talks have been replaced by talks given by a new public engagement team. The use of a dedicated team allows for individuals who have public speaking training and the use of a script with specific information and details that they want to convey. This has resulted in much larger audiences at talks (Woodfine 2012), although the impact and efficacy of the new style of talk has yet to be evaluated. The only formal talk that took place during the survey (about tarantula) was well remembered suggesting these new talks should be similarly successful. Events and programmes of formal talks are resource heavy and many attractions may not be able to afford to create multiple events or staffed interactive stations. Technology, interactive signage and other novel forms of engagement may, therefore, have a role to play in engaging visitors where staff are not available (Perdue *et al.* 2012; Waller *et al.* 2012). The focus group participants were open to the use of technology but had some cautionary tales of where they had encountered it before, particularly around crowding at interaction points and technology not working, which will need to be addressed.

Regular visitors were least likely to report learning. These should be the most engaged visitors so it is important that there be new information and layers of interpretation for these visitors to maintain their interest (Weiler and Smith 2009) and build towards changing behaviour through greater awareness, deliberation and reflection (Morris *et al.* 2012). At Marwell, awareness of the organisation's conservation activity increased with the number of visits, although the details remembered of what conservation work was undertaken were sketchy. This was reflected in the focus groups, with participants saying they would like to have more information on the conservation activity undertaken. Many zoos believe that visitors validate their visit with the thought that any money spent goes to a good cause (The Ocean Project 2009; Woodfine 2012). Knowing that their entrance fee is going to a cause they value has a strong feel good factor for these visitors and supports their personal wellbeing (Dunn *et al.* 2008). At Paignton and Newquay Zoos they concluded visitors did not want to know details of the activity; it was enough for visitors to know that something was being done (Plowman 2015, personal communication). Conversely, Ballantyne and Packer (2016) found that the majority of visitors in their study thought it was important to provide information about conservation, environmental issues and activity. The engaged subset of visitors at the focus groups reported here also wanted more information on conservation activity, so having this information available to those who want it is likely to be important for continuing learning and engagement.

Children were found to be an important driver in choosing where to go, both in choosing the destination for a day out and in choosing which locations to visit within the

attraction. Parents in the focus groups and responding on Facebook like to go to locations with learning opportunities for their children and where they go within that attraction is influenced by the needs and desires of the child (Turley 2001; Beaumont and Sterry 2005 and chapter 2). Within Marwell, it was apparent that those with children spent less time at animal exhibits and hence, although parents are choosing destinations with potential learning experiences for their children, these groups may not be spending sufficient time at exhibits to engage with the learning opportunities. Grandparents bringing children to the zoo were the least likely to have remembered any learning at the end of the day, followed by parents with children. While, in theory, parents may intend the visit to be educational (Falk 2006; Dingfelder 2009; Fraser 2009) young children will see playground spaces as the focus of the visit and rush through animal exhibits unless they are specifically designed to gain their attention (Wineman *et al.* 1996). To combat this, exhibits need to be designed to attract the younger audience and make learning fun through exploration, discovery and play, rather than play areas being separate from learning opportunities (Wineman *et al.* 1996; Moss and Esson 2010). Groups with children spend more of their day socialising, while groups without children spend more time reading signs (Ross and Gillespie 2009). If interactive elements of an exhibit can be made the focus of the groups socialising it should be possible to increase the learning in groups with children (Schwan *et al.* 2014). It should be noted that in the Marwell survey it was the grandparent or parent who was answering the survey and not the child. Just because the adult completing the survey could not remember learning from their day out, it does not necessarily follow that the children did not. Beaumont and Sterry (2005) noted that grandparents in particular tended to spend more time attending to the children than they did to exhibits, hence they are less likely to be learning than the children are. More work is needed talking to the children visiting the park to discover how much they are learning over the course of their visit.

Representatives from larger groups were the more likely to remember having learnt something from their visit suggesting the greater time spent at exhibits and social interaction around an exhibit may be contributing to learning, as found by Falk and Storksdieck (2005) and Clayton *et al* (2009).

Children also visit attractions on school visits where they are likely to have a different experience to when they come with a social group (Tunnicliffe 2000; Rickinson *et al.* 2004). Although the primary output of these visits is educational in nature, the desired outcome is the same as with day visitors, creating connections with nature that will encourage participation in the conservation of biodiversity and natural resources, either

now or in later life (Marwell Wildlife 2015). This study confirmed that children are learning about biodiversity on educational visits and, as found by Neves and Monteiro (2014), the visit is correcting common misconceptions about animals and their habitats. Demonstrating whether an individual is forming a genuine connection with animals or nature is difficult, particularly in children (Nisbet *et al.* 2009; Perrin and Benassi 2009; Cheng and Monroe 2012). The change in the favourite animals drawn or listed following the visit to animals that could have been seen during the visits suggests a connection may be being made that is more than simply remembering the animal a week later.

Following an educational visit the children were more likely to think that zoos were fun or exciting and that they were places of learning and conservation. Creating these positive associations between a fun day out, animals, learning and conservation of animals in their natural habitats is likely to instil sympathetic attitudes to nature in later life (Chawla 1999; Lohr and Pearson-Mims 2005; Zuo *et al.* 2016a).

In the period since the initial surveys were carried out there has been a considerable amount of work within the zoo to provide a coherent and engaging messaging style and increase the number of learning opportunities. This was highlighted during the focus groups who referred to better learning opportunities in the "newer" parts of the park. At that time the main new areas were: "Fur, Feathers and Scale", "Savannah Tracks" and refurbishment of the penguin exhibit. In each area signage was refreshed to provide bold images and clear, simple text. The "Fur, Feathers and Scale" exhibit is an area comprising two walk-through aviaries, Ring Tailed Coati (*Nasua nasua*) exhibit, Red necked wallaby (*Macropus rufogriseus*) and Cold Blooded Corner (a reptile house) and was designed to complement the national curriculum topics of working scientifically and identification of major animal groups (Department for Education 2014). These areas contain more of the popular interactive elements that were most likely to be memorable including interactive signage, talks and artefact tables where people can handle items and ask questions. Work is needed in these new areas to confirm whether the improvements have brought about the anticipated increase in learning.

7.3 Translating learning into behaviour change

Marwell's charitable objectives (Marwell Wildlife 2015) include:

> Encourage participation of individuals, communities and wider society in the conservation of biological and other natural resources and the environment. p3

Marwell aims to achieve this by providing close up animal experiences and learning opportunities throughout the park which they hope will engender a sympathetic attitude to nature and lead to the adoption of pro-environmental behaviour. Learning about nature and biodiversity, and raising awareness of issues and threats to biodiversity does not necessarily readily translate into action (Kollmuss and Agyeman 2002; Lorenzoni *et al.* 2007). To translate learning about the environment into environmental or conservation action requires the individual to make a personal connection with the subject, understand their place in the environment and finally understand how they can be a catalyst for change (Farmer *et al.* 2007; Ajzen *et al.* 2009). Learning at attractions such as zoos has been shown to be associated with an increased connection with nature (Bruni *et al.* 2008), a greater desire to protect animals in their natural environment (Clayton *et al.* 2009) and self reported intentions to adopt new behaviours (Pearson *et al.* 2013). At Marwell a small proportion of the surveyed visitors thought their visit could influence them to change their behaviour to reduce environmental impact and gave examples of changes they might make.

A slightly larger proportion of visitors to other attractions, particularly wildlife attractions, thought they had been influenced to change behaviour by their visit. In the focus groups littering messages were most frequently remembered from a variety of attractions, but particularly aquariums. Some participants stated that they had either changed behaviour after seeing this type of message, or had used the message as reinforcement for behaviours they were trying to get their children to adopt. People with children are more open to new ideas, have a more hopeful attitude to the future and are more willing to make changes to their behaviour to protect their child's future (Berland 2013). This includes changing behaviour to protect the environment but may be tempered by immediacy and localism of competing desires. For example, a parent may acknowledge that they should drive less to reduce emissions but will still drive their child to school if they perceive it is not safe for their child to walk alone and they do not have time to walk with them (McDonald and Aalborg 2009). The anecdotal reports from the focus groups and surveys suggest parents are conscious of a need to change behaviours for the benefit of their children and are keen to instil pro-environmental behaviours in their children. There were not enough participants reporting actual behaviour changes here, however, to determine if families visiting with children were more likely to adopt new behaviours than others. Many of the learning

opportunities at Marwell are aimed at children so more work is needed in this area to see how this influences the attitudes and behaviours of both children and their parents.

Connectedness to animals, and social connections to other people sharing that connection, have shown a correlation with a sympathetic attitude to action on climate change (Luebke *et al.* 2012; Clayton *et al.* 2013). Feeling a connection with nature and self identifying as being a part of nature are significantly associated with emotional responses and concern about significant threats to biodiversity such as climate change (Clayton *et al.* 2013) and pro-environmental behaviour (Mayer and Frantz 2004; Perrin and Benassi 2009). The engaged individuals in the focus groups showed a connection with animals through participation in nature based activities such as bird watching, photography and wildlife holidays and their desire to learn more. Despite this, they did not appear to be particularly engaged in pro-environmental behaviours. Both the focus group participants and Facebook followers felt that calls to action were a good thing even if they did not intend to act on them. Visitors expect conservation based attractions to be telling them about threats to biodiversity, want to receive messages about what they can do and feel that these types of message add value to their visit (The Ocean Project 2009; Luebke *et al.* 2012; Ballantyne and Packer 2016). There is clearly more for Marwell to do to move these engaged individuals from sympathetic attitudes to taking action.

Zoo and aquariums are considered trusted sources of information by their visitors (The Ocean Project 2009; Luebke *et al.* 2012) and the focus group sessions suggest this is also true at Marwell. The participants were anticipating learning opportunities on a day out, were at least willing to listen to messages encouraging action, and in many cases wanted to know what action they could take. Being seen as a trusted source, therefore, is important to the organisation as both focus group participants and Facebook responders were open to calls to action. They are unlikely act on those calls, however, if they do not trust the information or the source providing it (Kollmuss and Agyeman 2002; Luebke *et al.* 2012).

Some of the focus group participants reported feelings of futility or hopelessness when faced with messages regarding threats over which they had no control or influence. Messages that are disturbing or which engender feelings of futility can preclude action (Vining 2003; Esson and Moss 2013) so messages around threats need to be treated sympathetically and combined with information on what is being done to resolve the issues. Any call to action should, therefore, target specific behaviours the visitor can adopt to have a positive impact (Smith *et al.* 2008; Smith 2009). This appears to have

worked in the examples the focus group participants gave about littering messages, but not so for the palm oil message seen at another zoo. Not dropping litter is a relatively simple action to achieve and has a low personal cost, whereas reading packaging labels to find palm oil information and, potentially, paying a higher purchase cost for palm oil free has a higher personal cost which has been shown to inhibit take up (Lorenzoni *et al.* 2007; Smith *et al.* 2008; Steg and Vlek 2009; Moser 2015). The higher cost of seeking out sustainable palm oil products (both financial cost and personal effort) appears, on this occasion, to have prevented action from being taken.

Repeat visitors, which include those in the focus groups, were more aware of conservation work but were no more likely to change behaviour following their visit than less frequent visitors. Previous research into changing behaviour found that intentions to change behaviour were frequently not followed through and that the heightened awareness following a visit faded over time (Adelman *et al.* 2000; Dierking *et al.* 2004; Smith *et al.* 2008). Post visit reinforcement of messages is needed to embed newly attained knowledge, maintain commitment to change behaviour and follow through to enact that change (Ballantyne and Packer 2011). Multiple visits provide repeat exposure to messages over time that should be able to reinforce messages, increase knowledge (Pearson *et al.* 2013) and help to maintain awareness, but only if reminders are presented in a way that does not constitute message "fatigue" (Bitgood 2009), or "nagging" as the focus group members put it. Behavioural change happens over time so repeated exposure to similar messages should reinforce learnt concepts for visitors so they come to be seen as common or normal (Ballantyne *et al.* 2007; Everett and Barrett 2009; Hughes *et al.* 2011).

Several of the focus group participants had visited Marwell as children. These participants remembered being influenced by those visits at a young age and commented how this has influenced them in later life, in one case choosing a career as a biology teacher. More could be done to investigate this area, particularly with members of the Wild Explorers club[23], a group for children who attend regular events with the education team but was not included in this study due to time constraints.

Information about nature is widely available on TV, online and in magazines for those who are interested, so an attraction has to consider how it's messages fit within the wider context of information already available (Smith and Broad 2008). Those

[23] https://www.marwell.org.uk/zoo/tickets-experiences/annual-memberships?tabnum=2 formerly the Oryx club

interested in nature, such as the members who took part in the focus groups, are likely to access various of these other information sources and be relatively well informed. Less regular visitors looking for an occasional social day out may be less well informed so a different level of information may be needed. Interpretation needs to meet the needs of the day visitor while still having more depth for those who would like it (Ballantyne *et al.* 2008; Weiler and Smith 2009). Visitors are also likely to have some prior knowledge about threats to biodiversity (Falk *et al.* 2007), although misconceptions about threats are also possible (Dove and Byrne 2014). Encouraging visitors to take action will therefore require reinforcement of existing knowledge, correction of misconceptions and demonstration that action is both possible and effective (Kollmuss and Agyeman 2002; Thøgersen and Crompton 2009; Luebke *et al.* 2012). The focus group participants felt seeing exotic animals at Marwell was inspiring but, for the most part, did not remember any particular message or call to action, despite the findings of others that close up animal experiences with endangered species can engage audiences in pro-environmental behaviours (Ballantyne *et al.* 2007; Fraser and Wharton 2007; Luebke *et al.* 2012). Both focus group members and Facebook followers wanted to know what action they could take to reduce their impact on biodiversity so practical, solution-oriented information is needed if the attraction wants to influence visitors to change aspects of their behaviour or adopt new behaviours.

7.4 Incorporating learning and subsequent behaviour change into net positive calculations

Marwell Wildlife's charitable aims and objectives include advancing the education of the public and promotion of the conservation of biological and other natural resources (Marwell Wildlife 2015). A conservation organisation such as Marwell Wildlife does, however, run the risk through the operation of Marwell Zoo as a visitor attraction of having a greater negative impact on biodiversity than the positive outcomes of its conservation activity. At the same time, by attracting large numbers of visitors to the zoo, Marwell has the opportunity to inspire the necessary change in the behaviour in others needed to contribute to global action to reduce, and ultimately reverse, biodiversity loss. (UNEP 2010; Moss *et al.* 2014).

If the changes in behaviour seen over the course of this study can be replicated across enough visitors, and in enough action areas, the organisation may be able to compensate for the negative impacts of doing business. To be able to do this the

organisation needs to understand its various impacts and assess whether the impact of the behaviour modifiers for visitors are sufficient to alleviate or offset any residual environmental impact the organisation is not able to eliminate through other means. To demonstrate an overall positive environmental and social impact the organisation therefore needs to assess a variety of impact types and weigh up the relative contributions of differing activities. Given the difficulty in fully calculating financial value of natural and social capital (O'Neill and Spash 2000; Böhringer and Jochem 2007; Sukhdev *et al.* 2010) and the objections to comparing or offsetting different types of capital against each other (Green Monday 2013; Forum for the Future and The Climate Group 2014) the organisation could instead separate impacts into different categories, evaluate the contribution of visitor behaviour change in each category, and then assess the overall positive or negative impact in each. In the following sections the potential effectiveness of utilising the evaluation of visitor behaviour change in different categories of a net positive calculation is discussed.

7.4.1 Ecology and Natural Capital

Marwell has been funding conservation projects since the early 1980s and has had an active role in in-situ conservation since the 1990s (Wilkie *et al.* 2016; Woodfine and Gilbert 2016; Woodfine *et al.* 2017). A combination of ecological studies and conservation action has resulted in a body of literature demonstrating increases in natural capital as a result of this action (Marwell Wildlife 2017b).

Marwell encourages public participation in conservation through the children's Wild Explorers Club and corporate volunteering days. These groups take part in the active management of habitats in and around Marwell Zoo and it is hoped that at least some will be inspired to get involved in other projects in their own neighbourhoods. Whether this is successful or not has not yet been evaluated. During the exit survey reported in chapter 4, however, although some visitors reported a greater awareness of environmental issues, none suggested they might start taking part in active conservation activity. The zoo has some work to do yet to turn awareness into action in this area.

The operation of the zoo will impact on natural capital through its supply chain, through consumption of natural resources, including water and through climate change impacts from carbon emissions. Each of these will need to be managed to achieve an overall positive impact and in each area there will be opportunities to influence the behaviour of visitors to reduce impact beyond those of the organisation itself.

7.4.2 Materials and supply chain

Consumption of non-renewable or unsustainably sourced products can have a significant negative impact on the ecosystems from which they were extracted. To combat the risk of ecosystem degradation from the supply chain, Marwell has taken various actions to reduce the operational impact of the supply chain. For example, timber is either sourced locally from sustainably managed woodland or from sources certified by Forest Stewardship Council[24], the majority of products and food are palm oil free or use sustainable palm oil[25], fish (for animal feed and in the cafe) is certified as sustainably sourced by the Marine Stewardship Council (MSC)[26] and teas, coffee and snacks are Fair Trade[27] or Rainforest Alliance certified[28] (Marwell Wildlife 2014).

Despite these commitments there will be negative impacts from the non-renewable and non-recyclable materials used by Marwell. If Marwell cannot completely eliminate environmental damage from their own supply chain, they may be able to reduce damage elsewhere by encouraging visitors to reduce their own impact.

At the time of writing Marwell had some messaging encouraging visitors to consider the environmental impact of the things that they buy. This messaging is in the form of discussing sustainable fish and handing out Good Fish guides [29] during the penguin talk, labelling of confectionary as Palm Oil free, and inclusion in the Hampshire Fare directory[30] promoting the local food and drink sold in catering and retail outlets. The focus groups members were only aware of the use of Fair Trade tea, coffee and snacks but did not appear to have adopted these in their own homes. No work has been done as yet to determine the effectiveness of these campaigns in encouraging visitors to adopt these sustainable sources, other than counting the number of Good Fish Guides given out at talks.

Marwell has a variety of opportunities to highlight other sustainable purchasing options visitors could be choosing such as sustainable timber for home DIY projects or furniture, choosing local suppliers, shopping seasonally or growing their own food to name but a few.

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[24] http://www.fsc-uk.org/en-uk
[25] All animal feed is palm oil free or uses sustainable palm oil as are all snacks sold in retail outlets. A small number of items in the café contain uncertified palm oil
[26] https://www.msc.org/
[27] http://www.fairtrade.org.uk/
[28] http://www.rainforest-alliance.org/
[29] 1,600 Marine Conservation Society Good Fish Guides given out in 2016
[30] http://www.hampshirefare.co.uk/members/view/697/marwell-zoo

7.4.3 Water

Forum for the Future (2014) define a positive position for water as making more good quality water available than an organisation consumes. The value of water is location specific, and any compensation for water removed needs to be done where it is needed to maintain the healthy functioning of the ecosystem (Forum for the Future and The Climate Group 2014). Areas with an abundance or excess of fresh water could conceivably export virtual water, in the form of water intensive products, creating a net positive effect at the imported location (Hoekstra 2003). At Marwell's location in Hampshire, UK, the river catchment area from which Marwell obtains its water is considered fully utilised and a water-stressed area with risk of shortages during dry years, potentially resulting in insufficient water to maintain healthy river habitats (Environment Agency 2013; Environment Agency and Natural Resources Wales 2013). On site water consumption by Marwell is monitored through the ISO14001 environmental management system. Around 75% of the water used on site is returned directly to the ground through soakaways but there is still a net loss of water to the environment through the remaining 25% discharged to sewers and hard-surfaced areas channelling rainwater to the sewer. This water is then not available to the downstream habitats that require a certain level of flow to maintain a healthy functioning ecosystem.

The net consumption of around 10,000m^3 of water at Marwell's Hampshire site is likely to be dwarfed by the embodied water in products bought in. Some of this will be from the same catchment area, from local food suppliers for example, but most will be from much farther afield, possibly from areas with more significant water stress than the UK. As Hoekstra (2003) noted, importing water-intensive products from water rich areas to places with minimal excess water may be beneficial, but the relative abundance at both source and destination have to be understood to ensure a balance is maintained. This water will need to be included in future water footprint calculations to gain a full understanding of Marwell's water balance and what action is needed to achieve any degree of net positive position.

In order to reduce their local water impact and overall water footprint, Marwell could invest in some form of on-site water treatment plant or reed bed system that returns fresh water to the ecosystem as some others have done (Salix 2009) but these are expensive and require a lot of space. As Marwell already return the bulk of water abstracted to ground through soakways, they may be able to have a greater impact locally by using their own examples of water efficiency measures to inspire visitors and

local businesses to reduce their own water consumption, and hence reduce the total amount of water abstracted. In 2020/21 Marwell will open a water and wetland exhibit highlighting the importance of water both locally in the chalk streams and habitats of the South Downs, and internationally in the areas in which Marwell works. This will provide Marwell with an opportunity to talk to visitors about their water use and how this could be reduced.

If 1,250 visitors could be persuaded to turn the tap off while they brush their teeth, for example, the amount of water saved per year, and hence not abstracted from the local water table, would be the equivalent of Marwell reducing their net consumption to zero[31].

7.4.4 Carbon

Marwell has measured its carbon footprint each year since 2008 so changes in emissions from operation of the charity are known. Marwell will be publishing a carbon reduction strategy in 2017 which aims to achieve carbon neutrality by the end of 2020. This includes a residual amount of carbon which they are unable to eliminate and will therefore need to be offset, either by sequestering carbon or by reducing emissions elsewhere. This could be done through approved offsetting schemes under the Clean Development Mechanism (UNFCCC 2017) or forestry projects under REDD+ (UN-REDD 2016) or through sequestering carbon on their own land through woodland and habitat management projects.

Alternatively, the residual carbon emissions could be compensated for by encouraging visitors to reduce their carbon emissions by as much, or more, than the residual emissions. Various commercial organisations are working on this premise. In BT's 3:1 campaign BT aim to have a positive balance in carbon emissions by encouraging their customers to reduce their own carbon footprint by collectively 3x times the emissions produced by BT (BT 2016). Kingfisher group also aim for the combination of their own buildings and their customer's homes to generate more renewable energy than the group consumes each year and hence achieve a positive carbon balance (Kingfisher 2015). For Marwell to offset their residual carbon emissions this way would be the equivalent of asking the majority of visitors to reduce their carbon footprint by around

[31] Based on a saving of 8,000 litres per person per year, https://www.southernwater.co.uk/water-saving-tips-in-the-home

5Kg per year[32]. This is roughly equivalent to driving 12 miles less per year or changing one light bulb to a low energy equivalent (EPA 2016).

The survey results suggest getting a significant proportion of an attraction's audience to make a lasting change in behaviour, even one as small as those suggested here, may be a tall order. More plausible is getting a smaller proportion of the audience, the engaged individuals, to make a more meaningful change. Switching to a renewable energy source would save an average of 1.34 tonnes of carbon dioxide equivalent per household per year (Good Energy 2017). To offset all of Marwell's 500 tonnes of residual emissions would be roughly equivalent to visitors from 375 households switching to a renewal energy supplier each year.

To achieve a genuinely positive position, visitors learning about their own impacts need to be persuaded to move from understanding to taking action. Currently Marwell only has minor messages relating to energy saving ideas, but in 2018 they are opening a new tropical house exhibit[33] that aims to capture the visitor's imagination on energy flows in nature, how these relate to our own uses of energy and the solutions and actions that are available to visitors to reduce their own carbon footprints. Once completed, further work can be undertaken to see if there is an increase in carbon reduction behaviours in visitors.

7.4.5 Social Capital

The operation of an education or nature based attraction contributes to a variety of aspects of social capital. Rural attractions in particular can make a significant contribution to their local economy through direct employment and by supporting jobs at local suppliers and other attractions and facilities that may be visited by families on their day out or stay in the region (Sharpley 2007; Raluca and Gina 2008). If the attraction were an unscrupulous employer, however, paying low wages in poor working conditions, then the social capital impacts of employment could be negative rather than positive. In the case of Marwell all staff are paid above the living wage and the Best Companies programme[34] is used to gauge and improve staff wellbeing.

Providing a facility with a conservation mission that local people can engage with and take pride in can improve resident's opinion and emotional attachment to their local

[32] Based on a residual carbon footprint of 500 tonnes CO_{2e} and visitors from 100,000 households changing behaviour
[33] https://www.marwell.org.uk/zoo/explore/tropical-house
[34] https://www.b.co.uk/company-profile/?marwell-wildlife-99315

area, which also contributes to the local social capital (Harper and Kelly 2003). Conversely operating a large visitor attraction could have negative social impacts in the local area, for example through additional traffic. On a busy summer day, Marwell Zoo can bring an additional 1,000 cars onto rural roads of Hampshire which has the potential to impact local air quality and block roads if not carefully managed.

Educational attractions have the opportunity to benefit the human aspect of social capital through formal education opportunities from pre-school to post-graduate and informal education for families learning together on social visits (Helliwell and Putnam 2007; Huang *et al.* 2009).

On a personal level, family bonding was regularly mentioned in the survey and focus groups as a motivation for visiting the zoo. The social nature of learning in the zoo environment can alleviate stress, improve health and boost social capital in addition to the educational value of the experience (Maller *et al.* 2006; Keniger *et al.* 2013).

Conservation attractions such as Marwell often have in-situ programmes in other parts of the world with a strong social component. In Kenya Marwell assisted in establishing 19 community-led conservancy areas where local people are involved in various aspects of wildlife monitoring and recording, tracking and habitat management (Langenhorst 2012). Marwell also provides training opportunities with the establishment of a research centre and MSc bursaries in Kenya to build local conservation capacity and employment for local people in the areas where they have active conservation programmes (Langenhorst *et al.* 2006; Low *et al.* 2010).

Further afield negative social impacts that may arise through purchasing of products from less developed countries are minimised through a robust ethical purchasing policy which emphasises schemes such as fair trade and seeks to only purchase from companies with social awareness as well as environmental management programmes (Marwell Wildlife 2014). Visitor attractions have the potential to improve the welfare of the communities where many commodities are produced by highlighting the options available to their visitors such as Fair Trade and Rainforest Alliance (Ronchi 2002; Giovannucci and Ponte 2005).

7.5 Can a single measure of net impact be achieved?

With around 400,000 visitors each year, there is scope for Marwell Zoo to make a significant contribution to reducing global impact on biodiversity if even a modest proportion are persuaded to change some aspect of their behaviour. Quantifying the

impact of all the various different behaviour changes possible, and then incorporating them into a single overall measure of impact may, however, be a step too far at this stage. For quantifiable concepts, such as carbon dioxide emitted or fresh water consumed, and with sufficient data on supply chain effects, a total footprint calculation for the organisation could theoretically be made (Chapagain and Orr 2009; Pandey *et al.* 2011). The contribution of specific changes in visitor behaviour could then be factored into this calculation to provide an overall carbon footprint, for example. Some behaviour changes, such as changing electricity supplier to renewable energy, provide a readily quantifiable change that can be included in the footprint calculation fairly easily. Other self reported behaviour changes, such as driving less and using public transport more, are harder to quantify and are dependent on the accuracy of any data reported by the individual. Including these behaviour changes in an overall impact or footprint calculation would be possible, but the basis of the calculation and details of assumptions made, would need to be made clear in any reporting.

Resource consumption and ecosystem degradation from the operation of the organisation should also be estimable, with sufficient data, through ecosystem valuation techniques such as the Natural Capital Protocol (Natural Capital Coalition 2016), and with the necessary caveats around estimating non-use and future use values (Cicchetti and Wilde 1992; Jansson *et al.* 1994; Limburg *et al.* 2002). Changes in purchasing behaviour of visitors could then be factored in to this calculation but, as with the driving example above, self reported purchasing behaviours are very difficult to quantify. To report these impacts with any degree of confidence would require extensive surveying of visitors over time, which may be possible with repeat visitors and members, but would be very difficult with the majority of day visitors. Attractions may need to start with reporting numbers of visitors reporting a change in behaviour before developing methods for estimating the impact as they gain a better understanding of the lasting changes being made.

Measuring changes in social capital through the influence of a single organisation is a difficult proposition (Hutchins and Sutherland 2008) and attempting to incorporate behaviour change of visitors into this measure is likely to make it even more complex. An evaluation of learning, and connectivity with nature are possible measures of increases in different aspects of social capital (Mayer and Frantz 2004; Perrin and Benassi 2009) and economic impact locally could be estimated from local spend and wages paid. Measuring concepts such as family bonding and place attachment to the local region are far more difficult and incorporating these impacts into an overall impact assessment is possibly beyond the resources of a single visitor attraction.

For any attraction to count visitor behaviour change as part of their contribution to achieving pro-environmental outcomes they will need to be able to show that the behaviour change was as a result of their intervention or influence. People are exposed to a wide range of stimulus from television, print media, online forums, friends, family, school and work colleagues resulting in a moderate awareness of many issues prior to any visit (Eagles and Demare 1999). All of these will have some effect on a person's attitude, sense of connection with nature and intention to change behaviour, although this does not necessarily correlate with actual participation in pro-environmental behaviour (Vining 2003; Skibins and Powell 2013). Identifying the deciding factor that led to an actual change is very difficult, and even if it were possible and the attraction were identified as the deciding factor in a visitor making a particular change, the attraction may only be the final link in a long chain of influences that lead to the change. In the same way that additionality needs to be shown to claim carbon credits from work done elsewhere (Cames *et al.* 2016), the attraction will need to be sure that the behaviour change would not have occurred anyway, regardless of the visit. Zoos and aquaria have been shown to change the behaviour of some their visitors (Smith *et al.* 2008; Packer *et al.* 2010), possibly by providing the final push that triggered adoption of a behaviour that was already being considered (The Ocean Project 2009; Skibins and Powell 2013). With careful surveying, therefore, it may be possible to quantify the amount the attraction contributed to the final decision to adopt a new behaviour. In the end, however, they may have to settle for knowing that they were a part of the decision process that led to the change in behaviour.

Offsetting of environmental impacts such as carbon emissions or reduction in local biodiversity remain controversial, both in terms of their uncertain effectiveness and in normalisation and acceptance of the original damaging activity (Ervine 2012; Bull *et al.* 2013; Curran *et al.* 2014; Ives and Bekessy 2015; Bull *et al.* 2017). Given the difficulties involved in quantifying individual behaviour change and in attributing any change to the intervention of a single actor, inspiring behaviour change shouldn't be seen as a primary means of achieving a net positive position. Any organisation looking to have a net positive impact needs to address its own impacts and direct actions first before looking to incorporate change in others into their calculations.

Chapter 8: Conclusions and recommendations for further work

The combination of GPS tracking with entry and exit surveys was successful in determining the behavioural differences between various groups of visitors and in highlighting temporal variations in movement throughout the day. The combination was also successful in resolving behavioural differences with reported learning and intentions to change behaviour. The time taken to conduct the study with a sufficiently large sample size is likely to restrict this method to a periodic evaluation. Four fifths of the population, however, now carry a GPS tracker with them at all times in the form of a smart phone (Deloitte 2016). These have the potential to provide a wealth of data on location, movement and interaction as appropriate apps develop for interaction with exhibits (Dickinson *et al.* 2014) provided privacy issues can be addressed. The prevalence of smart phones also means monitoring and evaluation could be done continually, ultimately providing far larger data sets and allowing very fine grained analysis of variations caused by a wide range of factors. Marwell have started initial discussions internally and with other zoos around developing apps that include tracking functions using GPS outside and WiFi or ibeacon[35] technology inside buildings.

The study was also able to show that visitors considered learning to be an important part of their day out and that they are learning about animals and biodiversity over the course of their visit. The study highlighted the types of information that were that were most likely to be remembered and the methods of presenting information that were popular with visitors. Engaging the visitors' interest and curiosity at the various exhibits as active participants, rather than passive viewers, was found to be important for connecting them with the subject matter and creating learning opportunities. This concept will be used in the design of interpretation displays and interactive elements in the new tropical house opening in 2018 and in additional exhibits after that.

Schoolchildren were found to be learning on their visits and in particular, misconceptions were being corrected. The importance of a guide was highlighted, a role that could be performed by a well prepared and knowledgeable class teacher but may be better suited to specialist educators at the attraction. At Marwell the schoolchildren also appeared to be engaging with the conservation message, although

[35] https://developer.apple.com/ibeacon/

the evidence for this was variable. More work is needed to better understand how the specialist educators can assist class teachers who are not on a formal visit through provision of pre-visit information and post visit exercises. The drawing exercise used in this study was a significant undertaking that would be difficult to replicate on a regular basis. It could potentially, however, be adapted to a topic specific exercise which acts as both post visit reinforcement and evaluation of learning. More work is also needed to better understand the longer term implications on attitude and behaviour of formal school visits to the zoo.

This study was not able to include the children who attended the Wild Explorers club. These children have regular contact with zoo educators, some over a number of years, so evaluation of learning and attitude towards conservation of biodiversity with these children should be possible. Planning for a suitable evaluation method that can be repeated at intervals through the year has started at Marwell.

The study found only a small proportion of the visitors in the survey were influenced to change some aspect of their behaviour away from the zoo to reduce their impact on global biodiversity. The proportion of focus group participants stating they had changed, or were willing to change, some aspect of their behaviour was higher than in the survey participants reflecting the greater engagement of the focus group participants. The impact of the changes visitors had made, or were willing to make, is relatively small. More work is therefore needed to increase the proportion of visitors who are willing to change, and to create meaningful longer term change in a larger proportion of the audience. Marwell have a multi-year programme to upgrade older exhibits and create new ones to enhance the visitors experience which provides various opportunities to create engaging messaging and experiences that they hope will prompt further action.

Finally the study was able to suggest a mechanism, based on the Net Positive concept that is gaining momentum in the business community, to incorporate visitor behaviour into and overall evaluation of environmental impact. Obtaining sufficient data on all carbon emissions, embodied water and natural capital impacts for the whole supply chain is likely to be difficult, and possibly beyond the capability of a single attraction but, provided the scope of the calculation is defined and exclusions acknowledged, changes made by visitors in response to messages encountered on their visit could be set against these various footprint and ecosystem degradation measures on the positive side of the equation to reduce the overall impact. With sufficient action by

visitors the overall impact of an organisation in any one of these subject areas could then be shown to be positive.

As we have seen in chapters 4 & 5 however, people are exposed to many different sources of information and organisations trying to influence their behaviour. Separating out the impact of the single visit to one attraction from all the other sources of influence is likely to be impossible. As has been shown here and at other organisations, visitors do change behaviour following visits (Smith *et al.* 2008; Packer *et al.* 2010 and chapters 4 & 5) so organisations can measure the numbers of people changing behaviour and the likely impact of that change. The most they would be able to claim, however, is that in most instances they were the trigger or final nudge that tipped the visitor over into making a change they may have been considering for some time (Hausman and Welch 2010). Only with members who visit regularly over a number of years would it be possible to estimate the specific impact of the organisation, and even then only if they maintain regular contact with members or repeat visitors in the long term.

One area of potential concern seen here from the focus groups was the idea that paying an entrance fee or membership subscription to the organisation was sufficient action to prevent biodiversity loss. Some individuals expressing this opinion did not feel the need to take any further personal action because they were helping to fund a conservation charity to take action for them. Donating to charities in support of a cause the individual cares about improves their happiness and well-being (Dunn *et al.* 2008) but the marginal increase in conservation activity funded per person in this way is highly unlikely to be sufficient to reduce their own contribution to biodiversity loss. A similar effect was seen in a subset of car drivers (Anable 2005) where taking one action (in that case recycling) allowed them to feel it was acceptable to continue using the car, despite the action being insignificant compared to the emissions from driving. Providing more information on the scale of the conservation work done by the organisation they visit could potentially backfire if the amount being done is more than they imagine, or they feel it is sufficient to render any action by themselves as trivial or unimportant by comparison. More work is needed to determine how large this effect is and how many visitors subscribe to this point of view.

Educational attractions have the potential to influence the behaviour of a large number of people to reduce their environmental impact. Quantifying that change in behaviour for inclusion in overall environmental reporting may not be possible for individual attractions across the whole range of impacts. Where quantitative data is available the

positive impact of changes in behaviour should be reported alongside the negative impact of operating the attraction. In cases where quantifiable data is not available, the number of visitors reporting a change can still be reported against the appropriate impact, with an estimate of the potential environmental or social impact where a suitable methodology for conversion is available. Individual attractions may want to start with the more readily quantifiable impacts around carbon emissions and water use, before moving on to more complex areas such as ecosystem degradation and social impact.

Action by both individuals and organisations will be needed to reach aggressive targets such as those in the Paris agreement (UNFCCC 2015). If an organisation claims a visitor's actions as a means of offsetting their own impacts, there will still be a residual impact that has not been dealt with. Ultimately all impacts will need to be addressed to prevent significant environmental damage so, while an attraction should be commended for inspiring the adoption of pro-environmental behaviour, in the end they will need to address their own impacts and find a way of reaching a neutral impact position through their own efforts. From this point the inspiration of individuals to change behaviour can be seen as a genuinely positive additional contribution.

Appendices

Appendix 2:1 Greeting survey

Date _____ Time _____ GPS No. _____

Name _____ (we won't use this to send you anything)
Address _____
Address _____
Address _____
Address _____ Post code _____
Phone No. _____

How would you describe your group?

Solo visit	☐	Parents with children	☐	Larger family group	☐	Carer / Childminder	☐
Family and friends	☐	Grandparents with grandchildren	☐	Couple	☐	Friends	☐

How many people in your group in each of these age ranges

<3	3 - 11	12 – 16	17 – 25	26 – 35	36 – 45	46 – 55	56 - 65	>65

Please answer the remaining questions about yourself not your group

Age	< 16	☐	17 – 25	☐	26 – 35	☐			
	36 – 45	☐	46 – 55	☐	56 - 65	☐	>65	☐	
Gender	Female	☐	Male	☐					

What is your highest qualification?

GCSE	☐	GCE A level	☐	Higher education / degree	☐		
Postgraduate certificate or MSc	☐	PhD / MD or professional	☐	NVQ / City and Guilds / Apprenticeship	☐		

Annual household income	<£20K	☐	£20 - £25K	☐	£25 - £30K	☐	£30 - £40K	☐
	£40 - £50K	☐	£50 - £75K	☐	£75 - £100K	☐	>£100K	☐

Have you been to Marwell before	Never	☐	Came many years ago	☐	Once before within 3 years	☐	
	More than once before	☐	Regular - <3 times per year	☐	Regular - >3 times per year	☐	

Are you an annual pass holder YES NO
Do you have any pets? YES NO

What are your three favourite, non-domestic, animals

_____

Duncan East

What was your inspiration for attending today?

Please rate how important each of the following statements were to you when choosing to come to Marwell today. Rate each one between 1 and 5 where 1 means not important and 5 means very important

	Not important			Very important		Median
	1	2	3	4	5	
A visit to Marwell helps me to relax and unwind	11%	8%	30%	35%	15%	4
I like my family to experience nature / animals	3%	3%	10%	32%	52%	5
I support the mission to study, celebrate and protect wildlife	4%	7%	22%	33%	33%	4
It is one of the best places to visit round here	4%	3%	26%	39%	28%	4
I like to watch the animals	0%	1%	10%	42%	46%	4
I came a long time ago and want to revisit	49%	6%	12%	18%	16%	2
I frequently visit zoos when I go on trips	23%	22%	25%	19%	12%	3
It's a good place to entertain the kids for the day	17%	1%	4%	29%	49%	4
It was my partner / friends choice to come here today	40%	7%	18%	12%	23%	3
Coming here helps me to appreciate the value of nature	3%	4%	21%	41%	31%	4
I feel at peace in these surroundings	6%	7%	26%	38%	23%	4
I want to learn more about wildlife	2%	5%	23%	43%	27%	4
I wanted somewhere outdoors to come on a sunny day	14%	7%	18%	29%	32%	4
I like to draw / photograph animals	41%	14%	16%	15%	15%	2

Appendix 2:2 Numbers declining to take part

	Solo	Parents with children	Larger family group	Carer / childminder	Family and Friends	Grandparents with Grandchildren	Couple	Friends
Total number approached	2	795	250	17	126	92	187	55
Percentage of total approached	0%	52%	16%	1%	8%	6%	12%	4%
Number declining to take part	1	323	72	6	8	14	66	29
Percentage of those declining	0%	62%	14%	1%	2%	3%	13%	6%
Percentage of those approached	0%	21%	5%	0%	1%	1%	4%	2%
Number of participants	1	472	178	11	118	78	121	26
Percentage of those participating	0%	47%	18%	1%	12%	8%	12%	3%
Percentage of those approached	0%	31%	12%	1%	8%	5%	8%	2%

Appendix 2:3 Reasons given for declining to take part

Reason for declining to participate	Number of responses	Percentage
None given	154	30%
Member of party needs toilet	74	14%
Maybe later	66	13%
In a hurry	65	12%
Children will not stop	64	12%
Do not want to	38	7%
Meeting someone	14	3%
It's raining	12	2%
Did not speak good English	9	2%
Do not want to carry GPS unit	5	1%
Here for a specific event	4	1%
Not interested	4	1%
Partner does not want to	4	1%
Too much stuff to carry already	3	1%
Do not want to give personal details	2	0%
It's too cold	1	0%
Too much effort	1	0%
I'm too old for that	1	0%

Appendix 2:4 Results of demographic questions in greeting survey

Group type	Solo	Parents with children	Larger family group	Carer / childminder	Family and Friends	Grandparents with Grandchildren	Couple	Friends	
No. of responses	1	472	178	11	118	78	121	26	
Percentage	0%	47%	18%	1%	12%	8%	12%	3%	
Age of group members	<3	3 - 11	12 - 16	17 - 25	26 - 35	36 - 45	46 - 55	56 - 65	>65
No. of people	616	915	181	307	698	718	254	210	135
Percentage	15%	23%	4%	8%	17%	18%	6%	5%	3%

Age of participant	Prefer not to say	<16	17 - 25	26 - 35	36 - 45	46 - 55	56 - 65	>65
No. of responses	3	8	95	307	360	130	64	38
Percentage	0%	1%	9%	31%	36%	13%	6%	4%

Qualification of participant	None	GCSE	GCE A level	Higher Education	MSc or diploma	PhD or professional	NVQ	
No. of responses	27	170	119	341	102	86	159	
Percentage	3%	17%	12%	34%	10%	9%	16%	

Annual household income	Prefer not to say	< £20K	£20 - £30K	£30 - £40K	£40 - £50K	£50 - £75K	£75 - £100K	> £100K
No. of responses	63	139	144	151	149	232	63	63
Percentage	6%	14%	22%	15%	15%	23%	6%	6%

Previous visit	Never	Many years ago	Once within 3 years	More than once before	Regular < 3 times per year	Regular > 3 times per year
No. of responses	190	151	60	246	101	255
Percentage	19%	15%	6%	24%	10%	25%

Gender	Male	Female
No of responses	538	467
Percentage	54%	46%

Annual pass	Yes	No
No of responses	271	734
Percentage	27%	73%

Pet owner	Yes	No
No of responses	618	387
Percentage	61%	39%

Appendix 3:1 Exit survey page 1

Which animal did you spend most time looking at today?					
Why did you spend so long visiting this animal?					
Who wanted to stay looking at this animal?	You	Your child	Your partner	Other group member	Group decision

Where do you think you spent the most amount of time overall?					
Why did you spend so long in this location?					
Who wanted to stay at this location?	You	Your child	Your partner	Other group member	Group decision

Did you listen to any keeper talks, take part in any activities or trails today?			
Did you learn anything that was new to you from these?	YES	NO	
Can you describe what that was?			

Did you learn anything that was new to you from other sources during your visit?	YES	NO	
Can you describe what that was?			

Prior to today's visit were you aware of Marwell's conservation work?	YES	NO	
Which areas can you remember that Marwell are active in?			

Do you plan make any changes to your lifestyle as a result of today's visit?	YES	NO	
Please describe			

Appendix 4:1 Exit survey page 2

		Strongly disagree				*Strongly agree*
1	I recycle or compost all of my home and garden waste	1	2	3	4	5
2	Thinking about Marwell Wildlife encourages me to do more to reduce my environmental impact	1	2	3	4	5
3	Negative stories in the media discourage me from adopting environmentally friendly behaviour	1	2	3	4	5
4	Plants and animals have as much right as humans to exist	1	2	3	4	5
5	I always purchase local produce and environmentally friendly options	1	2	3	4	5
6	Adopting environmentally friendly behaviour is important to me	1	2	3	4	5
7	I have friends who choose environmentally friendly products	1	2	3	4	5
8	Being environmentally friendly is difficult for me	1	2	3	4	5
9	I always walk, cycle or use public transport for short journeys	1	2	3	4	5
10	I don't know enough about how my lifestyle affects the environment to make informed choices	1	2	3	4	5
11	Most of my neighbours recycle	1	2	3	4	5
12	I have changed behaviour at home, school or work as a result of a visit to Marwell	1	2	3	4	5
13	I feel happy knowing endangered species still exist in their natural habitat	1	2	3	4	5

Appendix 4:2 Public survey form

Date _____ Post code _____

When on a day out, what type of group you would go with?

Solo visit	☐	Parents with children	☐	Large family group	☐	Carer / Childminder	☐
Family and friends	☐	Grandparents & grandchildren	☐	Couple	☐	Friends	☐

What type of attraction do you enjoy visiting on a day out (tick all that apply)?

Ancient Monuments	☐	Historic Interest	☐	Parks and Gardens	☐
Theme Parks	☐	Wildlife attractions	☐	Museums	☐
Galleries / exhibitions	☐	Industrial Archaeology	☐	Themed Retail sites	☐
Amusement and Leisure	☐	Outdoor events	☐	Other (please specify)	☐

Which of the following best describes why you have not visited Marwell in the past?

Only for children	☐	Not interested in animals	☐	Can't get there / no transport	☐	Too far	☐
Too expensive	☐	Not heard of it	☐	Don't like animals in cages	☐	Other (please specify)	☐

Please answer the remaining questions about yourself

Gender		Age		Annual household income	
Female	☐	<16	☐	<£20K	☐
		17 – 25	☐	£20 - £30K	☐
Male	☐	26 – 35	☐	£30 - £40K	☐
		36 – 45	☐	£40 - £50K	☐
		46 – 55	☐	£50 - £75K	☐
		56 - 65	☐	£75 - £100K	☐
		>65	☐	>£100K	☐

What is your highest level of qualification?

GCSE	☐	GCE A level	☐	Higher education / degree	☐
Postgraduate certificate or MSc	☐	PhD / MD or professional	☐	NVQ / City and Guilds / Apprenticeship	☐

Do you have any pets? YES ☐ NO ☐

		Strongly disagree				**Strongly agree**
1	I recycle or compost all of my home and garden waste	1	2	3	4	5
2	Thinking about Marwell Wildlife encourages me to do more to reduce my environmental impact	1	2	3	4	5
3	Negative stories in the media discourage me from adopting environmentally friendly behaviour	1	2	3	4	5
4	Plants and animals have as much right as humans to exist	1	2	3	4	5
5	I always purchase local produce and environmentally friendly options	1	2	3	4	5
6	Adopting environmentally friendly behaviour is important to me	1	2	3	4	5
7	I have friends who choose environmentally friendly products	1	2	3	4	5
8	Being environmentally friendly is difficult for me	1	2	3	4	5
9	I always walk, cycle or use public transport for short journeys	1	2	3	4	5
10	I don't know enough about how my lifestyle affects the environment to make informed choices	1	2	3	4	5
11	Most of my neighbours recycle	1	2	3	4	5
12	I have changed behaviour at home, school or work as a result of a visit to an attraction	1	2	3	4	5
13	I feel happy knowing endangered species still exist in their natural habitat	1	2	3	4	5

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Appendix 4:3 Survey locations

Location	Survey date	Number of responses	Number who declined to take part	Number who had been to Marwell so could not take part
HMS Collingwood open day	04/06/2011	63	Not counted, most people did not stop	Not counted
IBM Hursley staff open day	18/06/2011	20	Not counted	Not counted, most people had been
"Spring into Summer" Nature event Southampton Common	26/06/2011	20	Not counted	Not counted, most people had been
Southsea carnival	16/07/2011	0	Event cancelled at last minute	
Olympic open weekend, Portsmouth Guildhall square	23/07/2011	25	Not counted	Not counted
Lunchtime Southampton city centre east parks	08/08/2011	9	Not counted, most people did not stop	Not counted
Itchen Valley Country Park	12/08/2011	0	0	All (approx 50)
Music in the park event, Godalming	14/08/2011	36	Not counted	Not counted, majority had not been
Queen Elizabeth Country Park, East Hampshire	15/08/2011	8	Not counted	Not counted
Basingstoke Town Centre	16/08/2011	2	Not counted, most people did not stop	Not counted
Southborne Beach during Bournemouth air show	20/08/2011	23	Not counted very few	Not counted estimated 50%
Boscombe Beach during Bournemouth air show	21/08/2011	34	Not counted very few	Not counted estimated 50%
Hayling Island West beach	22/08/2011	1	Not counted	Not counted

Moors Valley Country park, New Forest	31/08/2011	30	Not counted very few	Not counted
Moors Valley Country park, New Forest	01/09/2011	36	0	72
Bournemouth beach	02/09/2011	31	0	27
Romsey Show	10/09/2011	6	9	50
Netley pumpkin festival	08/10/2011	15	3	Too many to count, majority
Hayling Island West beach	26/05/2012	35	4	46
Moors Valley Country park, New Forest	04/06/2012	36	2	38
Moors Valley Country park, New Forest	09/06/2012	26	0	48
Olympic torch relay event, Salisbury	11/07/2012	33	3	36
Olympic torch relay event, Lymington	14/07/2012	7	1	14
New Forest Show	24/07/2012	40	29	179
New Forest Show	25/07/2012	35	39	268
New Forest Show	26/07/2012	36	38	276
Portsmouth Guildhall square	31/07/2012	15	20	25
Moors Valley Country park, New Forest	03/08/2012	35	6	86
Hayling Island west beach	10/08/2012	28	5	85

Hayling Island east beach	18/08/2012	26	6	25
Alum Chine, Poole	19/08/2012	34	14	28
Moors Valley Country park, New Forest	23/08/2012	41	6	80
Avon beach, Christchurch	26/08/2012	17	7	14
Southborne Beach during Bournemouth air show	31/08/2012	26	4	31
Boscombe Beach during Bournemouth air show	01/09/2012	28	14	84

Appendix 4:4 Gender variation across sampling locations

Location type	Number of participants	Male	Female
Beach	283	35.0%	65.0%
Nature / Country event	152	34.9%	65.1%
Navy open day	63	39.7%	60.3%
Country park	212	22.2%	77.8%
Other family event	147	33.3%	66.7%
Non-zoo average	857	31.9%	68.1%
Zoo	1005	46.5%	53.5%

Appendix 4:5 Group type variation across sampling locations

Location type	Solo	Parents with children	Larger family group	Family and friends	Grandparents with grandchildren	Couple	Friends
Beach	1.8%	42.6%	8.2%	29.1%	2.1%	14.2%	2.1%
Nature / Country event	2.0%	37.5%	2.0%	13.8%	9.2%	25.0%	10.5%
Navy open day	1.6%	30.2%	12.7%	39.7%	1.6%	9.5%	4.8%
Country park	0.9%	65.1%	5.7%	20.3%	5.2%	0.9%	1.9%
Other family event	8.2%	18.4%	4.8%	39.5%	0.7%	20.4%	8.2%
Non-zoo average	2.7%	42.2%	6.2%	26.8%	3.9%	13.6%	4.8%
Zoo	1.3%	45.0%	12.5%	18.8%	6.0%	12.8%	3.6%

Appendix 4:6 Age variation across sampling locations

Location type	16 and under	17 - 25	26 - 35	36 - 45	46 - 55	56 - 65	> 65
Beach	1.8%	8.5%	21.3%	35.1%	21.3%	7.4%	4.6%
Nature / Country event	3.3%	11.8%	20.4%	21.1%	14.5%	17.8%	11.2%
Navy open day	4.8%	22.6%	32.3%	17.7%	14.5%	8.1%	0.0%
Country park	0.0%	5.7%	25.5%	50.0%	8.0%	4.7%	6.1%
Other family event	2.1%	30.8%	28.1%	11.6%	15.8%	6.8%	4.8%
Non-zoo average	1.9%	13.2%	24.1%	31.0%	15.3%	8.5%	5.9%
Zoo	0.8%	9.5%	30.6%	35.9%	13.0%	6.4%	3.8%

Appendix 4:7 Education variation across sampling location

Location type	None	GCSE / O level	NVQ	GCE A level	Higher education	Postgraduate degree	PhD / MD / Professional
Beach	5.0%	21.9%	11.8%	13.3%	31.5%	12.9%	3.6%
Nature / Country event	7.4%	18.1%	8.7%	15.4%	30.2%	14.8%	5.4%
Navy open day	4.9%	24.6%	13.1%	18.0%	31.1%	6.6%	1.6%
Country park	1.9%	17.5%	9.0%	13.3%	37.0%	14.7%	6.6%
Other family event	1.4%	13.4%	8.5%	15.5%	37.3%	18.3%	5.6%
Non-zoo average	4.0%	18.9%	10.1%	14.4%	33.6%	14.1%	4.9%
Zoo	3.0%	16.9%	15.7%	11.8%	33.9%	10.1%	8.5%

Appendix 4:8 Household income variation across sampling locations

Location type	<£20K	£20K - £30K	£30K - £40K	£40K - £50K	£50K - £75K	£75K - £100K	> £100K
Beach	19.7%	15.9%	19.3%	14.6%	18.0%	7.3%	5.2%
Nature / Country event	22.2%	18.3%	19.8%	19.0%	8.7%	5.6%	6.3%
Navy open day	14.3%	28.6%	18.4%	18.4%	16.3%	2.0%	2.0%
Country park	14.7%	14.1%	21.8%	15.3%	21.2%	5.9%	7.1%
Other family event	29.1%	19.1%	5.5%	12.7%	15.5%	12.7%	5.5%
Non-zoo average	20.1%	17.3%	17.7%	15.6%	16.6%	7.1%	5.7%
Zoo	14.8%	15.3%	16.0%	15.8%	24.7%	6.7%	6.7%

Appendix 4:9 Variation in pet ownership across sampling locations

Location type	Pet owner	No pets
Beach	48.2%	51.8%
Nature / Country event	57.9%	42.1%
Navy open day	48.4%	51.6%
Country park	50.9%	49.1%
Other family event	40.4%	59.6%
Non-zoo average	50.7%	49.3%
Zoo	61.5%	38.5%

Appendix 4:10 Significant differences in time and distance in the park

	Agrees with 'Marwell encourages me to do more to reduce my impact'			Disagrees with 'Marwell encourages me to do more to reduce my impact'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 545)}$	P
Time at animals (minutes)	383	82.9	38.6	164	75.8	35.0	4.066	<0.05
Distance covered (meters)		5617	1686		5304	1649	4.004	<0.05

	Agrees with 'Negative stories in the media discourage me from adopting environmentally friendly behaviour'			Disagrees with 'Negative stories in the media discourage me from adopting environmentally friendly behaviour'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 780)}$	P
Time in Gift Shop (minutes)	64	6.2	8.3	718	3.9	7.0	6.156	<0.05

	Agrees with 'Plants and animals have as much right as humans to exist'			Disagrees with 'Plants and animals have as much right as humans to exist'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 840)}$	P
Time at playgrounds (minutes)	817	17.1	22.0	25	28.1	19.8	6.191	<0.05
Time at catering outlets (minutes)		29.6	24.5		43.2	26.7	7.331	<0.01

	Agrees with 'I have friends who choose environmentally friendly products'			Disagrees with 'I have friends who choose environmentally friendly products'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 710)}$	P
Time at catering outlets (minutes)	622	32.2	25.7	90	24.9	22.2	6.569	<0.05

	Agrees with 'I don't know enough about how my lifestyle affects the environment to make informed choices'			Disagrees with 'I don't know enough about how my lifestyle affects the environment to make informed choices'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 649)}$	P
Time in Gift Shop (minutes)	102	6.03	10.8	549	4.0	6.7	6.417	<0.05

	Agrees with 'Most of my neighbours recycle'			Disagrees with 'Most of my neighbours recycle'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 749)}$	P
Time at catering outlets (minutes)	701	31.7	25.8	50	21.5	18.8	7.624	<0.01

	Agrees with 'I have changed behaviour at home, school or work as a result of a visit to Marwell'			Disagrees with 'I have changed behaviour at home, school or work as a result of a visit to Marwell'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 661)}$	P
Time at animals (minutes)	81	88.9	40.1	582	77.9	36.3	6.355	<0.05
Time in playgrounds (minutes)		12.8	16.7		19.1	23.0	5.697	<0.05

	Agrees with 'I feel happy knowing endangered species still exist in their natural habitat'			Disagrees with 'I feel happy knowing endangered species still exist in their natural habitat'			ANOVA	
	N	Mean	SD	N	Mean	SD	$F_{(1, 885)}$	P
Time in Gift Shop (minutes)	871	3.9	6.7	16	8.7	19.7	7.009	<0.01

Appendix 4:11. Predictors of responses to the statement "I recycle all of my home and garden waste".

	F	p
Most of my neighbours recycle	$7.995_{(4, 1824)}$	< 0.001
Adopting environmentally friendly behaviour is important to me	$6.613_{(4, 1824)}$	< 0.001
Participant age	$4.962_{(6, 1824)}$	< 0.001
Being environmentally friendly is difficult for me	$4.160_{(4, 1824)}$	< 0.01
Visitor / non-visitor	$0.644_{(1, 1824)}$	0.423

Appendix 4:12 Significance of variation in demographic data across sampling sites

Factor	df	F	P
Group type	5, 1856	20.226	< 0.001
Gender	5, 1856	10.881	< 0.001
Age	5, 1850	9.365	< 0.001
Education	5, 1841	3.926	< 0.01
Household income	5, 1623	3.807	< 0.01
Pet ownership	5, 1856	2.027	0.072

Appendix 5:1. Focus group and Facebook questions

Topic 1: Finding information on nature, wildlife, conservation and biodiversity

Question 1: Where do you find information?

Devil's advocate – I don't look for information on these topics, I like to look at animals but I'm not interested enough to look for more information

Topic 2: Obtaining information on a day out

Question 2: Following on from the first questions, when you're on a day out with family or friends, how do you feel about having the opportunity to learn? Could be about biodiversity or wildlife or something else?

Devil's advocate – I'm looking for relaxation or fun when I go out, either for myself or to entertain the kids. I don't want to have to think about stuff, I do that enough at work

Facebook questions

2a. Quick question! How do you feel about learning on a day out? (either to Marwell or other attractions) Is it...

1 Nice if it's available
2 Something I look for, I prefer to go places where I can learn
3 Something I don't pay attention to, I don't go on a day out to learn
4 Other

2b. Quick question! How do you prefer to find out information at Marwell?

1 Reading signs
2 Attending talks from a keeper
3 Handling objects and asking questions at a touch table
4 Other

Topic 3: Ranking of information sources

Question 3: Thinking about the sources of information we've just discussed, if you were to rank these sources of information, where would you place Marwell in that list? Just roughly bottom, top, middling? Why

Devil's advocate – I always miss the talks as I'm never in the right place and I don't like reading signs so I don't think I gain any new information at Marwell

Devil's advocate – I'm already quite knowledgeable about wildlife so I haven't seen any new information at Marwell

Duncan East

Topic 4: Requests to take action

Question 4: If you see messages asking you to take action to protect the environment when you are out for the day how does that make you feel? Are you inspired or do you ignore them?

Devil's advocate –There are too many depressing images on telly about climate change and rainforests and stuff, I don't want to see more when I'm trying to enjoy myself

Facebook question

Paws for thought! We'd really like to know how you feel when you see or hear requests to take action to protect biodiversity on a day out? Have a think and let us know!

1 Depends on the context, if it's relevant to what I'm looking at I might take notice
2 I think it's important to be reminded about threats to biodiversity
3 I want to find out if there's anything I can do to help biodiversity
4 I find it intrusive, I go on days out to relax and have fun not be depressed by being told I have to change

Topic 5: Taking action

Question 5: Have you taken action or changed behaviour to preserve biodiversity in response to messages? If so how?

Devil's advocate – I've always been environmentally aware so haven't changed anything

Devil's advocate – You're forced to recycle at home now so don't have any choice

Topic 6: Inspiration

Question 6: Do you think visiting Marwell was a factor in encouraging you to make that change? Or perhaps you plan to, or think you should, change some behaviour but haven't done so yet

Devil's advocate – I think television and the news have a much stronger message that encouraged me to change

Facebook question.

Food for thought! Have you ever taken action because of something you've read or seen on a visit to Marwell? Not necessarily organised activity, just been inspired to do something new. Let us know what - we're always interested to know!

1. I already do stuff so haven't started anything new
2. I've donated to a specific campaign
3. Taken action at home, e.g. wildlife friendly gardening, put up bat / bird box, reduced waste at home, turn lights off more
4. Taken action other than at home, e.g. stopped buying certain goods, started buying fair trade or sustainable products, drive car less
5. Take part in conservation volunteering e.g. brush clearance, wildflower counts, bat or bird surveys

Appendix 6:1 Drawing exercise and survey form

Name	Age	Gender Boy / Girl
Class		

Please draw your favourite wild animal with all the plants and animals that live with it in the wild. (please put names or labels on everything)

Example habitats

Rainforest

Desert

Arctic

Sea

Please describe your drawing

Have you ever been to Marwell Wildlife?	Yes / No (circle one)
Have you ever visited other zoos?	Yes / No (circle one)

What words do you think of when you think of zoos

1 _____
2 _____
3 _____
4 _____
5 _____

Circle the words below you think best show what Marwell Wildlife is for.

Playing	Seeing animals
Learning	Sustainable
Making money	Days out
Looking after animals	Environment
Eating	Conservation
Ice Cream	Fun

The post visit form was identical except for the first two questions on the second page which were replaced with:

Did you enjoy your visit to Marwell Wildlife?	
How was your lesson at Marwell Wildlife?	

Appendix 6:2 Drawing scoring guide

Animal – scored on a scale of 1 – 5 for any of the following drawing attributes	
Body	Are shape and proportions approximately correct
Legs / limbs	Correct number and type e.g. two legs, two wings for birds, six legs for insects
Colour and markings	Approximate colours and markings present or not e.g. giraffe orange or brown patches
Distinguishing features	E.g. horns or beaks of approximately correct size and shape
Fur/feathers/scales	If drawn are they correct for animal e.g. lion's mane indicating fur
Habitat- score of 1 for appropriate habitat plus 2 – 4 depending on number of correct biotic and abiotic features	
Abiotic features	E.g. rocks, sand, ice. Are they correct for animal
Biotic features	E.g. Trees, grass, vines. Are they correct for animal
Text – Score 1 point for each correct and relevant piece of information	
Misconceptions – count the number of misconceptions from drawing or text, for example incorrect habitat or inappropriate association of animals	

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