The Role of Emotion

in Facilitating

Pro-Conservation Attitudes

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Abstract

Mitigating the impact of human activities on the environment is the biggest challenge of our time, but we lack a good understanding of the psychology that underpins people's attitudes to conservation of species and habitats. Zoos aim to promote conservation goals but there is a paucity of research to inform best practice. For example, despite European educational guidelines stating that member zoos must both deliver and evaluate conservation education, there is limited evidence that zoos are achieving these goals. This research examines whether facilitating zoo visitor engagement influences their attitudes towards conservation, as research literature indicates that emotional engagement has the potential to promote positive attitudes.

The first study examines the impact of facilitating an emotional connection to a chimpanzee on zoo visitor attitudes to conservation. Overall, results indicated that emotional connection may enhance some attitudes to conservation, but that visitor and exhibit characteristics are also important factors. The second study explored whether the type of information presented as interpretation influenced participants' attitudes to great apes and conservation. A zoo generally highlights physical information about a species (e.g. diet, habitat, range), whereas research suggests that humans are more likely to attend to information regarding social behaviour. The results indicated that physical information was more relevant, than social or husbandry information, but that social information was perceived as the most interesting, a finding validated by participants longer reading durations in this condition. However, attitudes to great apes and conservation did not differ between these three conditions and exposure to a negative or positive zoo incident involving great apes also had no impact on attitudes to their welfare or conservation. A focus group explored the experiences of young people attending a conservation and welfare programme in a zoo context, to provide a richer insight into how experiences may shape attitudes and behaviours. Four key themes were identified: Conservation, Welfare, Knowledge and Emotion, and a questionnaire identified participants' positive attitudes to conservation, welfare and emotion.

The ultimate goal of this research is to help enhance the promotion and efficacy of conservation education in the zoo, and a set of practical recommendations are provided for those working in zoo education. While zoos have considerable potential to contribute to conservation efforts, collaborative research will be necessary to address the challenges in this field and develop a sufficiently robust evidence base to inform best practice, in terms of both the implementation and evaluation of outcomes in conservation education.

Acknowledgements

Whilst collecting data for my BSc dissertation on butterflyfish object perception at the National Marine Aquarium, Plymouth, I was intrigued at the number of visitors keen to know more about my research. I would happily chat to the visitors (much to the detriment of training the fish and data collection) but would focus our conversation around issues threatening the marine environment. It was at this point, my interest in human attitudes and perceptions towards animals and conservation grew. During my MSc (in Zoo Conservation Biology), we spent a lot of time at Paignton Zoo, and I often wondered why there was not a greater emphasis on researching how best to educate the unforgotten species (humans) at the zoo. My MSc dissertation investigated whether visitors could collect reliable data on the location of fish and if this enhanced their attitudes to conservation. Inter-observer reliability yielded significant results, but this had no impact on attitudes to conservation, however visitors stated they really enjoyed the interaction. Therefore, I knew I had to further investigate this area of research.

Regarding the completion of this thesis, I wish to express my sincere gratitude to my supervisor Dr Sarah Vick for her support, enthusiasm and expertise throughout my years at Stirling. Her care and compassion during difficult periods, was at times all that kept me going. Thank you also to Dr James Anderson (my original, second supervisor) for his enthusiasm and feedback, and more recently to Professor Phyllis Lee, for her support and comments on drafts of my work.

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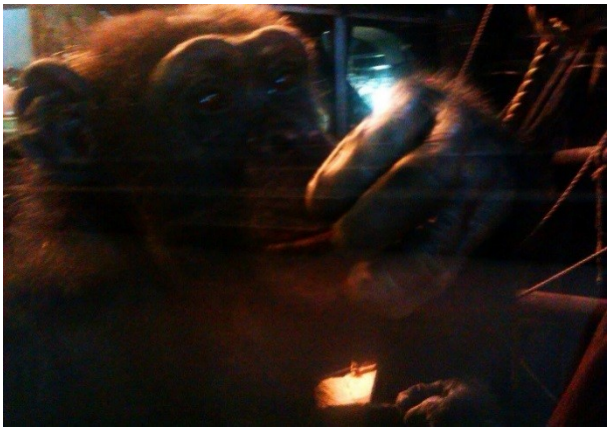

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"No one will protect what they don't care about;

and no one will care about what they have never experienced".

Sir David Attenborough (2013).

Author's Declaration

At no time during the registration for the degree of Master of Philosophy has the author been registered for any other University award. Work submitted for this research degree at the University of Stirling has not formed part of any other degree either at the University of Stirling or at another establishment.

The work reported in this thesis complies with the British Psychological Society's (2017) Code of Ethics and Conduct. Ethical approval was granted by the Psychology Ethics Committee at the University of Stirling, the Research Committee at Blair Drummond Safari Park and Edinburgh Zoo. Visitors to Blair Drummond Safari School and Edinburgh Zoo were invited to participate in study 1 (Chapter 2), research aims were explained, and consent given. All participants were aware they could remove consent at any time during the study or for three months after data collection. For those who participated in study 2 (Chapter 3), a summary of the research aims was available to read, and participants gave consent by continuing with the online study. Students in study 3 (Chapter 4) were given a consent and information sheet (explaining the aims of the study) and asked to discuss participation with their guardians as all participants were aged under 18. Guardians and participants were aware that conversations would be recorded during the focus group and deleted once data had been coded to NVIVO. Written consent was obtained from both guardians and students for them to participate.

Relevant seminars and conferences were attended at which work was often presented; courses were attended to develop specific skills and a paper submitted or prepared for publication. See below:

Additional Training:

Completed the University of Edinburgh Animal Behaviour and Welfare Course, provided by Coursera.Animal Behaviour and Welfare, Grade Achieved: 100.0%, Completed by Lesley Elizabeth Craig on Friday, November 11, 2016 10:34 AM

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Contents

1. A Review of Visitors' Conservation Learning in Zoos.

"In the end we will only conserve what we love, we will love only what we understand, and we will understand only what we are taught".

Baba Dioum (1968)

Abstract

Zoos aim to entertain and educate visitors and to engage in conservation and research activities. While the promotion of conservation is one of the core aims of zoo education, there is limited evidence that zoos enhance visitor pro-conservation attitudes and motivate behaviour change. To enhance zoo conservation education, it is important to evaluate research that has examined the impact of conservation education on visitor attitudes and behaviour. This review of the literature on zoo conservation education will summarise key findings such as the importance ofinteractive exhibits that focus on facilitating a positive emotional connection, the usefulness of a behavioural measure to triangulate self-reported attitudes, the need for pre-and-post measures of attitudinal change, without impacting visitor enjoyment and discuss implications for future research. A more comprehensive understanding of the various factors which impact on visitor engagement and learning is necessary to optimise zoo conservation education. Overall, there is a limited but growing body of evidence that zoo experiences can have a positive impact on visitors' knowledge and attitudes. However, learning at the zoo is complex because it can be shaped by multiple factors, including characteristics of visitors and of the exhibits and their interpretation. There are also methodological challenges in conducting research on conservation learning within the zoo context. Identifying those factors which underpin visitor engagement and facilitate learning is important to developing effective conservation education which ultimately benefits society and the environment.

1.1. Introduction

British and Irish Association of Zoos and Aquariums (BIAZA) approved zoos and safari parks attract over 30 million people each year (BIAZA, 2018). These institutions have evolved from concrete-built menageries, aimed solely at entertaining their visitors, to centres of research, conservation and education. Zoos have a legal requirement to promote education and awareness to the conservation of biodiversity under the provisions of the Zoo Licensing Act (1981), and BIAZA approved zoos must adhere to strict education guidelines set by the

European Association of Zoos and Aquariums (EAZA: see Table 1.1). The most common and cost-effective way for zoos to abide by the educational requirements is to provide the public with informative signage about the species and their natural habitat; some zoos will contribute more than others and the focus of each zoo will also differ. As well as providing signs about basic animal facts, zoos aim to encourage care and concern for animals, and inspire conservation action (Ogden and Routman, 2004). An educational strength of zoos is that they can communicate science using living examples (Falk, 1997), and can reach a wider audience than most other science centres, as they attract people who are not actively seeking education. While zoos emphasise the importance of their education and conservation roles zoo visitors often identify entertainment and enjoyment as their primary reason for attending (Morgan and Hodgkinson, 1999). Importantly, the EAZA education standards (Table 1) also require member organisations to engage in research to demonstrate the impact of their conservation education. However, it is not clear what forms of evaluation are undertaken as there is limited peer-reviewed evidence available regarding the efficacy of zoo conservation education (Moss and Esson, 2013).

Table 1.1. *The education standards formed by the European Association of Zoos and Aquaria (EAZA, 2008; 2016); member institutions are obliged to adhere to these education standards.*

Summary of the EAZA Education Standards
Conservation education must be a core activity which is reflected in mission statements, interpretation and staffing, and planning and evaluation strategies. Zoos must provide research to demonstrate the impact conservation education in zoos has on people's knowledge, attitudes and behaviour towards the natural world.

Given zoos' educational responsibilities, it is important they understand who their visitors are and what they expect from their visit. Roe et al (2015) investigated the priorities of zoos as identified from their own perspective and those of their visitors. This quantitative and qualitative study involved distributing an online questionnaire (62 items, including open-ended and closed responses) to 593 zoos from 48 countries (in Asia, Europe and America) with a 32% return rate achieved. Using a five-point rating scale (very low priority - very high priority) the questionnaire aimed to investigate the priorities of zoo education, the type of education and the perceived education needs of zoo visitors. Out of 191 zoos, those factors considered to be very high priority included "a place for visitors to learn about animals" (93%), "for school children to learn about animals and conservation" (92%) and "a place for visitors to learn about conservation issues" (88%). Of 540 zoo visitors surveyed at these zoos, very high priorities included "a place for school children to learn about animals and conservation" (97%), "a place

for visitors to learn about animals" 94%), "a place for visitors to see animals from other countries" (91%). In addition, 81% of zoo visitors prioritised "learning about actions they can take home to help conservation". Only 17 visitors (3%) stated they had no agenda to learn at the zoo. Roe, McConney and Mansfield's (2015) findings indicate that both zoos and their visitors consider learning about nature and conservation to be among the highest priorities. However, this study did not consider important factors which may influence the zoo visitor experience and their engagement with education. The species and activity level of animals, visitor characteristics (age, gender and personality), the interpretation at each exhibit, and their motivation for attending have been shown to shape the visitor experience and their engagement with conservation education (Erlanger and Tsytsarev, 2012; Hayward and Rothenberg, 2004; Lukas and Ross, 2009; Milfont and Sibley, 2012; Myers, Saunders and Birjulin, 2004).

1.1.1. Visitor Motivation

Morgan and Hodgkinson (1999) investigated the motivation for visiting a zoo; education versus recreation, and intrinsic (for themselves) versus altruistic (for others). The results suggested that 22.1% of visitors to this zoo were motivated to attend for purposes of altruistic recreation, and 18.8% attended for altruistic education; more than 75% of the visitors were part of a family group and this explains the high recreation and altruistic score. It is possible that adult family members received some educational benefit through teaching their children and/or learning together. However, the presence of children could also negatively impact the learning opportunities for adults as they may have had less time to read signs and therefore were less receptive to educational messages. For example, Ross and Gillespie (2009) found that 82.8% of 338 visitors without children spent significantly longer attending to signage, than those with children. Zoos are rich with stimuli, e.g. the behavioural activity of animals, and these are likely to attract the attention of visitors'more than conservation messages of the exhibit or signage. However, previous research identified zoo visitors were more likely to donate to elephant conservation if they had an emotionally engaging experience of watching the animals (Swanagan, 2000). Similarly, Hacker and Miller (2016) found a significant relationship between active behaviours in zoo housed elephants and positive conservation attitudes and behaviours of visitors.

1.1.2. Exhibit Interpretation

The perceived priority of education for zoo visitors is supported by 95% of visitors reporting reading at least some exhibit signage (Roe and McConney, 2014). However, self-report can be influenced by desirability and behavioural measures may be more informative regarding visitor activity. For example, Bitgood et al (1988) investigated visitor dwell time at exhibits and found the average visitor spends as little as two minutes at a zoo exhibit, therefore exposure to education information is brief. Randler et al (2012) assessed knowledge retention,in school children (N = 845, 10-12 years old), regarding vertebrates before and after a zoo visit. Although the same content was provided on signage in both conditions, those who engaged in a structured guided tour by a zoo educator scored more highly than those in the unstructured visit, therefore suggesting that the latter group did not engage with the interpretation available and supports Bitgood et al (1988). However, although dwell times can be used to assess visitors' general interest in an exhibit (e.g. Bowler et al, 2012) the actual time spent reading signage at an enclosure is a more direct measure of interest in educational materials. It is difficult to design interesting and engaging interpretation where visitors will take away the desired message (Woods, 2002). The main reason visitors gave for not reading exhibit signs was that they were watching the animals (Roe and McConney, 2014), suggesting that visual interest and strategic sign placement is also important. Furthermore, 53% of visitors stated familiarity with the information, uninteresting information, and too much material caused them to discontinue reading signs (Roe and McConney, 2014). Engaging and interesting interpretation with clear and concise messages, placed in strategic locations is critical for encouraging visitors to read them.

Knowing what information zoo visitors expect to see on exhibit signs is important to improve engagement and conservation education. Fraser et al (2009) conducted a visitor survey, across two aquariums and three zoos, to establish what type of information visitors thought should appear on exhibit signs. Using a 19-item closed-ended scale and open-ended questions, they found visitor preferences were consistent irrespective of animal species and establishment. Overall, 51% of visitors stated diet was the most interesting fact to include on an exhibit sign, 34% of visitors thought interesting facts and behaviour (e.g. reptiles are poisonous) should be included on exhibit signs, and 31% said information regarding the endangered status of animals was important to include. Other information that visitors reported being of least importance included, length of pregnancy (7%) and scientific name (2%), suggesting less interest in biological learning. While zoo visitors displayed high levels of agreement when rating learning

about animals and conservation as very high priorities (Roe, McConney and Mansfield, 2015), there appears to be less consensus about visitor preferences regarding the specific type of information that should be included in signage. These preferences for content type presumably reflect visitors' differing level of interest in aspects of biology, behaviour, habitat or conservation and highlights a challenge in providing engaging and informative signage for a diverse audience.

While zoo education focuses primarily on physical information e.g. habitat and diet, this contrasts strongly with other media, for example, natural history documentaries focus much more on social interactions and often provide a narrative of individual life histories to inform viewers about animal behaviour and conservation. More research should be conducted to investigate the level of interest that humans have in social information over other information. Some zoos present information on the individual life stories and family structures of animals, but there has been no empirical evidence investigating how engaging with zoo animal's social lives could enhance the visitor experience or engage them with learning materials. The social brain hypothesis argues that both human and non-human primates evolved to deal with social, rather than ecological, information (Dunbar, 1998). This was echoed in one experiment by Mesoudi et al (2006), which investigated which type of information (gossip, such as social relationships, individual behaviour and information about the physical environment) participants would recall with greater accuracy. They found participants recalled gossip information significantly better, than individual behaviour and information about the physical environment.

The impact of interpretation is generally evaluated using knowledge tests and self-reported attitudes following a visit to an exhibit. Mallapur et al (2008) conducted a survey at three Indian zoos to assess the efficacy of their conservation efforts and found that zoo visitors answered more questions correctly on the behaviour, biology and habitat of a native species in India (lion-tailed macaques) than non-zoo visitors. For example, 74% of zoo visitors (at one site) could describe the lion-tailed macaque in comparison with 45% of non-zoo visitors. Lukas and Ross (2005) reported that visitors performed 60% better on knowledge questions regarding chimpanzees and gorillas when exiting the zoo as opposed to entering, but there was no measure of how long visitors retained this information. They also found that repeat visitors' attitudes towards conservation were more positive than those of first-time visitors. Although the researchers implied a cause and effect relationship regarding visitors' behaviour and attitudes, previous research has also demonstrated that zoo visitors are generally more

concerned about environmental issues than other members of the public (Adelman et al, 2001; Adelman et al, 2003).

1.1.3. Conservation Education

Conveying the complexity of conservation to zoo visitors is challenging. One misconception is that biodiversity can be achieved by protecting a few wild habitats for the enjoyment of humans, reflecting a lack of understanding of the relationship between species and habitats, which is critical to our survival and those species that share this planet (WAZA, 2011). Zoos recognise these challenges and build exhibits that do not just focus on the display of the individual animal, but also try and create natural looking environments that aim to provide appropriate behavioural opportunities for animals, and to better educate visitors about the animals and their ecosystems (Fraser, 2007). However, zoo visitors often do not realise the relationship between their own actions e.g. recycling, donating to charities, and wider conservation efforts (Ballantyne et al 2007). Beyond the zoo context, research indicates that awareness of the relationship between species and their habitats is improving, and the demand for eco-tourism and sustainable products are increasing (Liu, 2003), indicating that the public are receptive to conservation messages.

To optimise the impact zoo conservation education efforts, a better understanding of how visitors engage with learning opportunities is necessary to underpin strategies to promote conservation and consolidate existing positive attitudes and behaviours.

1.1.4. Connection to Nature

To understand how emotion could influence conservation learning we need to understand the emotional responses humans have towards animals and nature. The biophilia hypothesis (Kellert and Wilson, 1993) can provide some understanding of human emotional responses toward animals. Biophilia proposes that humans have an innate desire to engage with nature, although it must be noted that not all experiences of nature are positive. Although this evolutionary theory is difficult to test, as it is based on the idea that all humans are genetically predisposed to affiliate with nature, there is broad and growing evidence that contact/exposure to nature is generally beneficial to human health (Kaplan and Kaplan, 1989; Clayton and Myers, 2009), and that a lack of contact could result in nature-deficit disorder (Taylor and Kuo, 2001).

Zoos may be restorative environments;the Attention Restoration Theory (ART) claims that people's attention levels are increased after interacting with nature, or viewing pictures of nature (Kaplan and Kaplan, 1989). This theory is similar to the biophilia hypothesis as both argue that humans have an innate desire to interact with nature. Everyday humans require constant attention to tasks and the effort to focus can lead to fatigue and poorer cognitive function but can recover given a restorative environment and the chance to experience nature. Pals et al, (2009) investigated whether the zoo environment had restorative features. Participants completed a questionnaire aimed at measuring perceived restorative characteristics, whilst walking through two zoo attractions; a butterfly garden and a baboon exhibit. The results suggested that visitors to those exhibits exited with feelings of fascination and escape and the authors concluded that zoos could be restorative environments. However, there was no pre-visit or other control condition so that the specific impact of these two exhibits are hard to assess. Also, only positively worded items were included on the questionnaire which could have resulted in acquiescence bias. ART within zoos, could reduce stress and improve attention but it is unclear whether this would be more successful than other activities or environments.

The popularity of zoos and aquariums attracting 700 million visitors worldwide (World Association of Zoos and Aquaria, 2018), could arguably provide support for the biophilia hypothesis and ART, as zoos offer their visitors an opportunity to experience nature. However, ART does not indicate that animals are an important factor, this theory focuses on the benefits of connecting with natural environments. Research indicates that connecting with zoo animals is important when enhancing attitudes to conservation, but there has been limited examination of those factors that help promote a positive and meaningful experience for zoo visitors.

Conservation education aims to improve the public's understanding of the importance of relationships between species, the environment and individual attitudes and actions (WAZA, 2005). However, humans are becoming distant from nature, with at least half of the world's population living in cities (Rosenzweig et al, 2018). Zoos are mostly located in urban conurbations, providing an opportunity to engage with nature in a recreational context. Louv (2006) suggested that humans, especially children, are interacting with nature less and believes this can disrupt the child's ability to connect with it, so called nature-deficit disorder. Taylor and Kuo (2001) suggested that nature-deficit disorder could result in behavioural problems such as attention deficit hyperactivity disorder (ADHD) and provide some evidence that contact with natural environment can reduce behavioural problems in children with ADHD.

However, research in this field does not demonstrate causal links as other factors such as low income, poor education, and restricted access to nature could negatively influence the behaviour of children (Strife and Downey, 2009).

While humans may generally be predisposed towards animals and nature, there is considerable variation in how people perceive and interact with other species. Kellert (1980) conducted a large survey, in the United States of America (USA), investigating knowledge and attitudes towards wild and domesticated animals using open-ended and closed-ended items on a questionnaire. Kellert (1980) identified eight dimensions (Table 1.2) that explained attitudes to animals, with the highest rating on these in both adults and children being labelled a Humanistic attitude (reflecting interest and affection towards animals), which is specifically related to the emotional attachment humans' form towards animals. Kellert's study identifies the range of different attitudes humans can have towards animals; this is likely to be important in a zoo context, in terms of recognising the variability in visitors' pre-existing attitudes and in identifying how such factors might impact on motivation and learning experiences. For example, attitude style may contribute to preferences for the type of information presented in zoo interpretation.

Table 1.2. *Kellert's (1980) attitudes to animals in order of prevalence in the USA.*

Dimension label	Description of traits loading onto each dimension
Humanistic	Interest/affection for individual animals e.g. pets.
Moralistic	Opposition to cruelty of animals.
Negativistic	Avoidance of animals due to fear or indifference.
Utilitarian	Concern for the practical value of animals and their habitats.
Ecologistic	Concern for the interrelations between wildlife and their habitats.
Naturalistic	Interest/affection for wildlife.
Dominionistic	Interest in controlling animals.
Scientific	Interest in the biological functioning of animals.

Hayward and Rothenberg (2004) found that being attached to non-human animals (e.g. gorillas) and may provide a basis to care about wider biological communities (e.g. exotic species and habitats). This shows the importance of emotional attachments in zoo visitor education and is further support for the use of flagship species in zoos. Lukas and Ross (2009) modified Kellert's attitude and knowledge questionnaire, so the questions were more specific to great apes, and surveyed 1,000 visitors attending the gorilla and chimpanzee exhibits at Chicago's Lincoln Park Zoo. Overall, visitors answered 60% of knowledge questions correctly, exit surveys had a higher score than entrance surveys, while older and more educated people performed better on the knowledge questions, and were more likely to know about the conservation status of the apes than younger and less educated people. There was an association between those who were more educated and knowledgeable, and lower Negativistic and Dominionistic attitudes. This finding highlights the importance of education in facilitating improved attitudes towards apes and the threats they face in the wild.

1.1.5. Emotional Responses to Animals

There is a growing body of evidence indicating that a positive emotional response to animals is an important factor influencing conservation learning in zoo visitors (Dierking et al, 2002; Falk and Gillespie, 2009; Myers and Saunders, 2002; Myers, Saunders and Birjulin, 2004; Vining 2003; and Smith, Weiler and Ham, 2008). Live events and exhibits at an aquarium that generate positive emotions have been shown to be highly memorable (Adelman, Falk and James, 2001), suggesting that powerful emotions can improve the recall of information. However, the researchers did not test for pre-and-post visit changes in attitudes that could be

attributed to the visit. While live interpretation can be effective in facilitating enjoyment and learning, the quality of activities varies across establishments. Skilled presenters with an engaging and informative style, and active animals have been shown to increase visitor receptivity to learning, whereas unskilled presenters can have a negative effect on visitor learning (Falk, 2006; Perdue et al, 2012).

Myers et al (2004) suggested that zoo visitor emotions vary according to species, activity level of the animal and the visitor-animal connection. Myers et al (2004) asked visitors "what are your feelings towards the animal?" using a scale stating 17 emotions (e.g. beauty, respect, fear, disgust), and reported higher levels of positive emotion and a stronger sense of connection to the gorilla, less for the okapi and almost no emotion or connection to the snake. They also found women reported stronger emotional responses than men. The higher levels of emotion and stronger sense of connection to the gorilla supports the use of zoos using flagship species to support conservation and donate money. The results also provide evidence for the "similarity principle," which proposes that humans attend more to animals who they consider to be like themselves (Plous, 1993). Flagship species are commonly large bodied mammals e.g. pandas, tigers and primates. Myers et al (2004) concluded that zoos can provide visitors with positive emotional experiences and this could influence conservation learning. For example, students in school learn and perform better when feeling happy and excited about the subject matter (Oatly and Nundy, 1996).

Hayward and Rothenberg (2004) used pre-and-post visit surveys to investigate whether a gorilla exhibit could improve visitor knowledge about the wider ecosystem. Visiting the gorilla exhibition helped 88% of visitors understand that destruction of the rain forest had a devastating effect on the animals that inhabit it. The study also found that 86% of visitors said the exhibit had a large impact on their knowledge of conservation issues, and 67% stated the purpose of the exhibit was to educate the public about conservation. Overall there were significant differences in exit and entrance surveys, interactions between visitors and gorillas were considered to be positive, and this led to visitors becoming more knowledgeable and concerned about gorilla conservation (Hayward and Rothenberg, 2004). However, visitor knowledge was self-assessed, there was no facilitated interaction between the visitors and gorillas, and they did not explicitly measure emotional responses to the gorillas.

Powell and Bullock (2014) surveyed zoo visitors' predispositions toward nature, the positive emotional experience they reported whilst at the zoo, and whether these experiences led them

to become more conservation orientated after viewing three exhibits housing tigers, African wild dogs and hyenas. Visitors' predispositions towards nature and conservation were strongly correlated with reporting strong emotional connections to the animals. They also investigated whether using enrichment to stimulate the carnivores' natural behaviour could affect emotional responses in visitors and found a significant positive correlation between activity and visitor responses. However, as Powell and Bullock (2014) did not use a control condition it remains unclear what visitors' responses on the survey would have been before visiting the carnivores. Like Myers et al (2004), Powell and Bullock (2014) found women reported stronger emotional responses than men, but there was no effect of age in adults on emotional responses reported. Although more research is needed, there is some evidence that a visit to a zoo can lead to a greater awareness of conservation issues and that emotional responses to animals could influence conservation learning (Myers et al, 2004; Powell and Bullock, 2014; Hayward and Rothenberg, 2004).

1.1.6. Other Factors Influencing Attitudes to Animals and Conservation

There is much variation in attitudes and the factors that shape these have yet to be understood. For example, it has also been shown that pet keeping in childhood led to higher levels of empathy in early adulthood (Paul and Serpell, 1993). It is thought that early childhood experiences with pets can help maintain contact with nature (Paul and Serpell, 1993). However, the relationship between demographic variables and attitudes was found to be small. There is some evidence that individual differences e.g. personality traits, can also affect attitudes towards animals and the environment. Milfont and Sibley (2012) suggested that when investigating attitudes towards protecting the environment and conserving nature, researchers should consider the personality traits of participants. After all, personality traits have been shown to influence beliefs, values, attitudes, knowledge and emotion. Milfont and Sibley (2012) used a 10-item inventory (Gosling et al, 2003) to assess the "Big Five" personality traits (Costa and McCrae, 1992); Neuroticism, Extraversion, Agreeableness, Conscientiousness and Openness to experience. Participants were also asked to complete a questionnaire, developed by Milfont and Sibley (2012), aimed at investigating environmental attitudes. They found Agreeableness and Conscientiousness were positively associated with environmental engagement and pro-environmental attitudes, followed by Openness to Experience. This study did not test the effect of age and education on environmental attitudes, but the results suggest the importance that personality traits can have on attitudes. Therefore, zoo educators should try

designing educational strategies that accommodate the variation in visitor personality traits and the impact these have on visitor engagement and learning.

In addition to age and education (Kellert, 1988), gender may also affect attitudes to animals (Driscoll, 1992; Erlanger and Tsytsarev, 2012; Hills, 1993; Kellert and Berry, 1987). Gender differences in relation to visitor learning in zoos has received little attention, although Kellert and Berry (1987) found gender is among the most important demographic influence on attitudes toward animals. Kellert (1984) found male children were more knowledgeable about an animal's biological characteristics, whereas female children were more likely to disagree with subordination of animals and showed more affection towards domesticated pets (which shows the importance of using different strategies to engage visitors in zoos). Similarly, Kellert and Berry (1987) found adult women expressed stronger emotional attachments to individual animals (e.g. pets) and were more likely to reveal anthropomorphic feelings towards animals, than adult males.

It is rare that people act as individuals, most of our behaviour is social and people behave accordingly for every social group i.e. family, friends, work colleagues etc. Recent studies have indicated that social influences can play an important role in promoting conservation behaviours, for example, identifying social norms can lead to individual behavioural change (Schultz et al, 2007). It is important to be aware of how a conservation message is framed and how this influences perception of social norms. Information that is designed to discourage environmentally destructive behaviour may have the opposite effect if the message is ambiguous. For example, "environmentally destructive behaviour is socially unacceptable but common" indicates that destructive behaviour is a social norm (and therefore may be perceived to be acceptable). However, there is evidence that social norms can be used effectively to frame pro-conservation messages. For example, the simple statement "75% of guests who stayed in this room used their towels more than once" resulted in 50% of guests re-using their towel, compared to 30% in response to the original message "help save resources for future generations" (Cialdini, 2003). The importance of the precise framing of information within zoos has not been fully considered. Zoo educators could benefit from an understanding of psychological processes, such as using social norms, when developing messages designed to enhance attitudes to conservation and promote behaviour change. For example, the use of signs to promote recycling of mobile phones such as, "chimpanzee and gorilla habitats are at risk from coltan mining – a metal used in our mobile phones, recycle your old mobile phones and help save our cousins".

How information is contextualised is central to the impact of the message. For example, Bowler et al (2012) conducted a study at Edinburgh Zoo to investigate the impact live, explained research sessions had on visitor dwell times. The results suggested that visitor dwell times were 55.7% higher when a scientist was observed working with the primates, compared with 16.9% when there was no research activity occurring in the exhibit. Visitors were interested in science and engaged for longer when the live research was explained. Although Bowler et al (2012) did not measure conservation learning, this study may have important implications for conservation education strategies. For example, including a conservation message while research in zoos is being conducted could lead to more visitors engaging with conservation education, although there isno indication of how this could inform exhibit design and education. Carson (2012) investigated how visitors perceived zoo animal research and reported that use of the term 'research' was associated with negative perceptions. Carson (2012) concluded that zoos need to recognise how their signage terminology is understood by a range of visitors; interest and understanding will be enhanced by effective explanation of research activities (Bowler et al. 2012).

1.1.7. Impact of Species Characteristics and Representation

Plous (1993) investigated participants' willingness to conserve several species; gorilla, rhino, crane, lizard, catfish and beetle, and found 74% of participants preferred to conserve the gorilla, than the rhino, crane, catfish and beetle. Participants reported choosing to conserve the gorilla as it was more similar to humans than the other species. Plous (1993) termed this the "similarity principle" and suggested that this influences attitudes and perception of different species. This has been echoed in a more recent study, where participants preferred to adopt a charismatic species, irrespective of conservation status (Colleony et al, 2017). In addition to similarity, a more neotenous appearance has been found to positively influence people's attitudes to animals (Borgi and Cirulli, 2013; Serpell, 2004). Tisdell et al (2007) suggested the "cuteness effect" influenced willingness to donate more money to conserve species that are similar to themselves and deemed attractive. Furthermore, Gunnthorsdottir (2001) found animal physical attractiveness and similarity to be an important factor when deciding which species to conserve.

Humans tend to anthropomorphise other animals that can lead to misinterpretations of animals' behaviour but can also strengthen emotional bonds and create a sense of identity with them (Jacobs, 2009). Newberry et al (2017) investigated whether assigning an owl a name improved knowledge retention. Participants were shown a 50-minute presentation which aimed to

educated them on the behaviour and conservation of owls. A live owl was shown to the participants, in the experimental group he was called 'Henry', whereas in the control group he was referred to as 'barred owl'. The results suggested that naming the owl led to participants retaining significantly more information than in the control group.

The context in which animals are commonly presented is important in shaping people's perceptions and attitudes. For example, Ross et al (2008) investigated the influence context can have on how great ape conservation messages are perceived. They surveyed members of the public and found 95% of respondents thought gorillas were endangered, 91% perceived orangutans to be endangered, and only 66% believed that chimpanzees were endangered. Thirty-five percent of survey respondents explained (in a follow-up question) that the underlying reason for the differences in perception of endangered great apes was because chimpanzees are often seen on television and films and their images often appear on comical greeting cards. Media representations of certain species may need to be addressed in zoo education materials and considered when selecting merchandise for the giftshop to avoid undermining conservation messages.

Schroepfer et al (2011) found participants that had viewed a chimpanzee conservation message were more likely to perceive this species to be endangered, than those viewing a video showing naturalistic chimpanzee behaviour, or training of chimpanzees in advertisements. Additionally, 35% of participants that viewed the training of chimpanzees in advertisements thought it was acceptable to own a pet chimpanzee, compared with 10% of participants that viewed the video of the conservation message and those that viewed the naturalistic chimpanzee video. Nekaris, Campbell, Coggins et al (2013) analysed comments from viewers after watching a YouTube video of a human 'tickling' a slow loris. They found 25% of viewers wanted to keep a slow loris as a pet, however when information about their conservation was added this dropped to 10%.

Ross et al (2011) investigated the impact of human presence in images on the perceived conservation status of chimpanzees. A sample of images were used, including a chimpanzee in an office setting and standing next to a human. They found participants who viewed a photo of a chimpanzee with a human were 35.5% more likely to state that chimpanzee populations were stable, compared with those viewing the same photo with no human, and human presence also increased the probability of participants wanting a chimpanzee as a pet. Ross et al (2011) used photos of juvenile chimpanzees and did not consider whether the results would be applicable to

older individuals. Leighty et al (2015) replicated Ross' (2011) study and investigated whether viewing non-human primates (capuchin, lemur and squirrel monkey) with and without human presence, in a naturalistic setting or office setting affected attitudes to conservation status. The results suggested that when viewing the image of a non-human primate in company with a human the possibility of perceiving the animal not vulnerable to extinction increased, this also corresponded with an increasing wish to keep the non-human primate as a pet. Leighty et al (2015) did not report if there was a difference between species and attitudes to conservation status. Overall, these studies indicate that the framing of messages and use of images and videos can have a significant impact on how other species and their conservation is perceived by the visitor. For example, direct human-animal interactions (when an infant animal needs to be hand-reared by a keeper) and photos are often published in the media and on zoo websites, but these may prove to be counter-productive in achieving conservation education aims.

1.1.8. Interactive Exhibits

There is evidence that interactive exhibits could make visitors more focused on conservation issues. Many BIAZA approved zoos have full-time education officers, and education centres used for teaching groups of students. Most zoos have talks by keepers at feeding times and animal demonstrations, all of which exist to educate the public about conservation. Swanagan (2000) found that adding an interactive element, such as elephant training to the exhibit led to more people returning petitions about elephant conservation, than when there was no interactive exhibit. However, Swanagan (2000) did not consider whether the presence of zoo staff affected the number of petitions being returned. Dotzour et al (2002) investigated the effect of an interactive game, which promoted pro-environmental behaviour, on the behaviour of zoo visitors. They found that zoo visitors who had played the game were four times more likely to pick up a brochure about how to help save the earth, than those who did not play the game. Perdue et al (2012) studied the effects of three education conditions (no presentation, video presentation and live presentation), two of which aimed to educate visitors about the impact of palm oil on orangutans and their habitats. The length of time visitors stayed at the exhibit and a knowledge retention survey were measured. In the live presentation condition 83.4% of visitors correctly recalled that palm oil production is resulting in the destruction of orangutan habitats, compared to 32.5% in the video presentation condition and 0.85% in the no presentation condition.

Interactive exhibits may be important in facilitating social learning experiences. For example, Borun et al (1997) investigated the effect of interactive exhibits on family learning, defined as

an exchange of knowledge in response to an exhibit. Borun et al (1997) measured family learning in a zoo by observing whether a member of the family was asking a question, answering a question, commenting on or explaining the exhibit and reading signage information silently or aloud. There was 83% higher content in conversations relating to the interactive exhibit compared to a standard exhibit, leading Borun et al (1997) to conclude that interactive exhibits do promote family learning. Overall, interactive interpretation seems to be beneficial to visitor experiences and learning outcomes, although the factors shaping the learning experience are not yet well understood and some aspects may be difficult to measure in situ.

1.1.9. Summary

To engage visitors in learning opportunities to inform their understanding of conservation zoos need to take advantage of every opportunity to educate. Zoos must adhere to the EAZA education standards (Table 1.1) and publish evidence-based research on effective strategies and tools that enhance the visitor experience and foster learning opportunities e.g. interactive exhibits which focus on facilitating an emotional connection. Zoo education is complex and shaped by multiple factorsincluding visitor characteristics and attitudes (personality, gender, motivation, existing knowledge), the visitor experience at the zoo (species, activity, interaction – including the type of context of information available), and the immediate impact on enjoyment and learning. A more comprehensive understanding of the various factors which impact on visitor engagement and learning is necessary to optimise zoo conservation education and contribute to wider social and environmental impacts.

1.2. Thesis Aims

Four key aims were identified:

1. To examine the impact of enhancing an emotional connection to animals in facilitating positive attitudes towards animal and conservation (Chapter 2)
2. To examine whether the type of information presented as interpretation influences people's attitudes to animals and conservation (Chapter 3)
3. To explore the experiences of young people participating in an intensive programme, to provide insight into factors shaping learning at attitudes towards animals and conservation (Chapter 4)
4. To consider the practical implications of the research findings for conservation education in a zoo context and develop a set of recommendations for enhancing practice.

2. Engaging Zoo Visitors at Chimpanzee (Pan troglodytes) Exhibits Promotes Positive Attitudes Towards Chimpanzees and Conservation.

"Thanks for that hen, I really feel like I know more about our cousins now".
A male visitor, post-emotion enhancement task (Blair Drummond Safari Park, August 2013).

Abstract

Understanding how visitor engagement with interpretation impacts on their attitudes to conservation is necessary to develop effective zoo-based conservation education. This study investigated whether facilitating an emotional connection between a visitor and an individual chimpanzee was more successful at enhancing attitudes to conservation than standard zoo interpretation. Attitudes to conservation were assessed post visit using a 12-item questionnaire focusing on predisposition towards nature, attitudes to chimpanzees, and conservation. Visitors at two chimpanzee exhibits, were allocated to an emotion enhancement condition (N = 227) or a standard interpretation control condition (N = 203). At one exhibit, visitors were also allocated to a third condition which presented an interactive task (location) without emotional enhancement (N = 216), and a behavioural measure of willingness to donate to chimpanzee conservation was also included for a subset of participants (N = 125). Participants were also recruited to an online control condition (without a zoo visit, N = 216). Principal component analyses identified two components: Naturalistic and Humanistic. At one exhibit, both Naturalistic and Humanistic attitudes to conservation were significantly more positive

following the emotion enhancement condition than for the standard interpretation or online control condition. At the other exhibit, both the emotion enhancement and location condition led to higher Humanistic scores than in the online only condition, but neither was higher than for standard interpretation at the same exhibit. The likelihood of donation to chimpanzee conservation was not influenced by condition. While emotional enhancement may be effective in promoting pro-conservation attitudes, this is dependent on contextual factors (e.g. exhibit design and interpretation). Moreover, attitudes were influenced by stable visitor characteristics (pet ownership, zoo membership, and personality) and are therefore likely to prove difficult to influence, at least during a single zoo visit. Visitor and animal characteristics, and the interpretation of the exhibit all shape the visitor experience; understanding these interactions is important in facilitating effective zoo conservation education.

2.1. Introduction

As human populations continue to grow, the impact on wildlife and their habitats has dramatically increased. For example, 54% of the 633 species and sub-species of primates living today are classified as threatened with extinction on the IUCN Red List (Chapman and Gogarten, 2012). The main threats to biodiversity are attributable to human activity; habitat loss and fragmentation, invasion of alien species, wildlife trade, pesticide use, pollution, overexploitation of food and natural resources, and climate change (Sherrow, 2010). Increased awareness of how humans' impact on the environment has led to the emergence of the field of conservation psychology, which aims to improve understanding of human behaviours and attitudes and promote care for nature (Clayton and Myers, 2009). There are two techniques used to conserve species; In-situ and Ex-situ. In-situ conservation, conserving species in their natural habitats, is considered the most effective way of conserving biological diversity. Ex-situ conservation, conserving species outside of their natural habitat, involves captive breeding of animals in the hope of reintroducing them into the wild, and/or housing them in zoos, aquariums for research and public awareness (e.g. Powell and Bullock, 2014; Myers, Saunders and Birjulin, 2004).

While zoos increasingly endeavour to educate visitors about biodiversity and promote conservation awareness, there has been limited research on the factors that determine the impact of a zoo experience on visitor behaviour and attitudes (Lukas and Ross 2014; Marino,

Lilienfeld, Malamud et al, 2010). Characteristics of the visitor (gender, age, personality), characteristics of the animals (species, activity), and the interpretation of an exhibit (Fraser, Bicknell and Sickler et al 2009; Roe and McConney, 2014), are all likely to shape the visitor experience and their engagement with conservation education. However, most zoo visitors state their motivation for visiting is for either recreation or entertainment, rather than identify learning as a primary goal (e.g. Reade and Waran, 1996), indicating that emotional experience rather than knowledge acquisition is likely to be key to zoo visitor engagement (Powell and Bullock, 2014).

Previous research indicates the emotional experience of zoo visitors can be an important factor in positively influencing conservation learning (Falk and Gillespie, 2009; Myers, Saunders and Birjulin, 2004; Smith, Weiler and Ham, 2008). Myers et al. (2000) propose that positive emotional experiences facilitate conservation learning in zoo visitors. For example, higher levels of enjoyment of events at an aquarium were associated with visitors' enhanced recall of information about species conservation (Adelman, Falk and James, 2001). Zoo visitor emotional responses vary according to species, activity level of the animal, and the visitor-animal connection (Myers, Saunders and Birjulin, 2004). Myers et al. (2004) asked zoo visitors to rate 17 emotions (e.g. beauty, respect, fear, disgust) towards three species, and found higher levels of positive emotion and a stronger sense of connection to the gorilla than the okapi, with almost no emotional response or sense of connection to the snake. These results provide support for the "similarity principle," which proposes that humans attend more to animals who they consider to be like themselves (Plous, 1993; Colleony, Clayton, Couvet et al, 2017). The enhanced emotional response and stronger sense of connection to the gorilla also corresponds with the use of charismatic flagship species (commonly large bodied mammals) to support conservation efforts (Skibins et al, 2017). In support of the hypothesised link between emotional experience and conservation attitudes and behaviour, Swanagan (2000) reported that zoo visitors were more likely to donate to elephant conservation if the experience of watching the elephants was perceived as emotionally engaging.

Similarly, Powell and Bullock (2014) found that visitors' predispositions towards nature and conservation correlated with stronger emotional connections at three exhibits(tigers, African wild dogs and hyenas). Emotional responses were also enhanced by the provision of enrichment to stimulate the carnivores' natural behaviours, which had a positive impact on conservation mindedness (Powell and Bullock, 2014). However, because all measures were collected after participants had visited the exhibits and in the absence of a control condition, it

remains unclear what visitor's perceptions were before visiting the exhibits and whether perceived emotional connection enhanced conservation mindedness or vice versa. Overall, the limited evidence available suggests that a visit to a zoo can lead to a greater awareness of conservation issues (Hayward and Rothenberg, 2004), and that emotional responses to animals are also likely to influence conservation learning and attitudes (Luebke et al; 2016; Myers et al, 2004; Powell and Bullock, 2014).

Participant variables are also likely to shape both experiences and attitudes. For example, pet keeping in childhood could help develop more positive and empathetic attitudes to animals and humans in early adulthood, (Paul and Serpell, 1993), although, the relationship between demographic variables and attitudes found was small overall. Milfont and Sibley (2012) suggested that personality traits should also be considered when examining conservation attitudes, because personality traits influence beliefs, values, attitudes, knowledge and emotion. Milfont and Sibley (2012) used a 10-item inventory to assess the "Big Five" personality traits (Costa and McCrae, 1992); Neuroticism, Extraversion, Agreeableness, Conscientiousness and Openness to experience. Participants were also asked to complete a questionnaire on environmental attitudes; Agreeableness and Conscientiousness were positively associated with environmental engagement and pro-environmental attitudes, followed by Openness to experience (Milfont and Sibley, 2012). In line with research on attitudes to animals more broadly (Kellert and Berry, 1987), studies have also reported stronger emotional responses in female than male zoo visitors (Myers et al, 2004; Powell and Bullock, 2014). An age effect has also been reported, with zoo visitors over 50 years old performing better than their younger counterparts on post visit knowledge tasks (Lukas and Ross, 2005).

I predicted that promoting an emotional connection to an individual chimpanzee would enhance positive attitudes to conservation and chimpanzees, when compared to a standard interpretation control condition at the same exhibit, and that zoo visitors overall would have more positive attitudes than an online (no zoo visit) control group. Previous research also indicates that sex, age, personality, and other characteristics (e.g. pet owing) are also likely to impact upon conservation attitudes and these factors are also considered. Finally, to examine whether self-reported conservation attitudes were related to measures of behavioural intention, additional measures were used, specifically willingness to join the zoo or conservation charity, and willingness to make a hypothetical donation to chimpanzee conservation.

2.2. Methodology

Participants: A total of 715 participants (293 females and 422 males) aged between 18 and 70 were recruited. Participants were recruited from visitors to Blair Drummond Safari Park's (BDSP) Chimpanzee Island boat tour (N = 302, 116 females and 186 males, age M = 41.3, SD = 16.1), and Budongo Trail at Edinburgh Zoo (BTEZ; N = 197, 81 female and 116 males, age; M = 29.2, SD = 12.3). Visitors at BDSP (July 2013 – September 2013) and BTEZ (November 2013 – March 2014) were approached by the researcher at the chimpanzee exhibits and asked whether they would like to participate in a short study. Online participants (N = 216, 96 female and 120 males, age; M = 27.1, SD = 10.2) were recruited via advertisements on the University of Stirling website and via social media. Data were collected using the Bristol Online Survey for the online condition (January 2014 – April 2014). The age category of participants (18-25, 26-35, 36-45, 46-55, 56-65, 66+ years) was estimated by the researcher at both exhibits, but in the online condition participants entered their own age.

This study adheres to the ethical standards of the British Psychology Society (2018), and ethical approval was granted by the University's Ethics Committee for Psychology and by the research coordinators at the two facilities. Specifically, informed consent was sought; all participants were provided with information regarding the requirements and duration of participation and informed of their right to withdraw at any stage.

2.3. Locations

Blair Drummond Safari Park (BDSP): There are five chimpanzees (1 male) housed at BDSP. The island has a circumference of 400 metres, the outdoor area is 8 metres x 15 metres, the large indoor area is 18 x 10 metres and the small indoor area is 10 x 10. The indoor areas are not visible to the public. Data collection was conducted on a boat that takes 20 minutes to travel around the island enclosure of the chimpanzees. Once underway, visitors were invited to participate in a five-minute study, and between two and six visitors were recruited per trip. In terms of interpretation at the exhibit, there is a sign (where visitors queue) providing basic information regarding the chimpanzees e.g. their natural habitat and typical diet. While on the boat, keepers make a short presentation explaining physical information and state the current threats to wild chimpanzees. Visitors are also given basic demographic information on the group, and some details of their individual histories.

***Budongo Trail at Edinburgh Zoo (BTEZ)*:** This exhibit has three (each 120m$^{2)}$ interconnected indoor enclosures and he outdoor enclosure is 1832m^2. Each of the enclosures have glass viewing galleries where visitors can observe 18 chimpanzees (eight males), and a large window overlooks the outdoor enclosure. Within the visitor area the interpretation available aims to educate visitors about chimpanzee conservation and encourage donations to a related field site for wild chimpanzees; there is a central station with interactive exhibits, touch displays, information about the species, and voluntary educational officers are often present.

2.4. Procedure

Online participants completed a short survey on their attitudes to conservation and chimpanzees. The 12-item questionnaire used a five-point Likert scale. Participants rated their level of agreement or disagreement with each of the statements; six of the items were positive and six were negative in relation to animals and conservation (see Table 1). Items were adapted from visitor attitude questionnaires used by Lukas and Ross (2005) and Powell and Bullock (2014). Participants were also asked to provide information on their pet owning and zoo membership status, and likelihood of joining such an organisation in the future.

Participants allocated to the Control conditions at BDSP (N =141) and BTEZ (N =62) completed the same questionnaire while at the chimpanzee exhibit (at BDSP this was on the return boat journey). Participants allocated to the Emotion condition (BDSP; N = 160, and BTEZ; N = 66) were firstly, shown a laminated card with a list of attributes associated with the "Big Five" traits (Costa and McCrae, 1992). Visitors were asked to identify which of the following best described their own dominant personality trait: Neuroticism (Vulnerable, Anxious), Extraversion (Excitable, Sociable), Agreeableness (Affectionate, Trusting), Conscientiousness (Organised, Thoughtful), Openness to Experience (Curious, Adventurous). Participants were then assigned an individual chimpanzee that was the same sex and scored highly on their selected trait (previously assessed using the Hominoid Personality Inventory, Weiss et al. 2007; Herrelko et al. 2011). Participants were provided with a laminated A4 card with a clear frontal photograph, with the personality trait labelled and list of attributes for the chimpanzee (e.g. "Agreeableness: Your chimpanzee is called Rosie, she is affectionate and trusting - just like you!"). Participants were asked to observe their allocated chimpanzee for up to five minutes and fill in a simple data sheet to record behaviour (such as grooming, playing, resting, or eating), then complete the questionnaire.

At BTEZ only, a third condition was added to examine to control for the influence of participation in an interactive task while in the exhibit. Participants allocated to the Location condition (N = 69) were asked to record the location of all visible chimpanzees on a schematic diagram of the enclosure. A behavioural measure was also introduced following questionnaire completion for a sample of BTEZ visitors (across all three conditions, N = 125). Participants were given a tennis ball and asked to drop into one of three buckets to indicate their preferred donation choice; chimpanzee conservation, Scottish wildcat conservation (a major funding initiative at BTEZ at the time of data collection) or to donate to neither.

2.5. Materials

2.5.1. Questionnaire

A short survey was developed from two previously validated longer scales used in visitor attitude studies (seven items from Lukas and Ross, 2005, and five items from Nisbet et al, 2009). The Lukas and Ross (2005) questionnaire contained (positively and negatively worded) 28 items and the items selected were those which assessed attitudes to chimpanzees. Lukas and Ross's (2005) factor analysis revealed six components (Naturalistic, Ecologistic, Moralistic, Negativistic, Utilitarian, Dominionistic and Humanistic), which revealed a partial replication to Kellert's (1979a) 10 categorizations of human attitudes to animals. Nisbet et al (2009) developed a scale designed to assess the affective, cognitive and physical relationship people have with the natural world. Their questionnaire contained 30 items, factor analysis generated three components (nature relatedness self, nature relatedness perspective and nature relatedness experience). Three items were adapted from the self component, one from the perspective component and one from the experience component.

2.6. Statistical Analysis

To facilitate interpretation of items, the negative items on the questionnaire were reverse scored. A principle component analysis was used to identify a reduced number of uncorrelated variables from the data set. A one-way ANOVA was used to explore differences between mean scores on the components extracted across condition.

A Hoechberg's GT2 post-hoc test was used (as samples sizes varied considerably, Field 2013) to establish where condition means differed for each component. The mean scores for items loading on to extracted components were calculated to facilitate interpretation of data. A Chi-squared test was used to investigate whether there was an association between condition and hypothetical donation choice. A one-way ANOVA was used to explore differences between mean score of items loading on the components extracted and hypothetical donation choice. A Hoechberg's GT2 post-hoc test was used to establish where charity choice differed for each component. One participant was undecided on donation charity choice and this response was omitted from subsequent analyses. A multiple linear regression (with enter method) was conducted to establish whether there was an association between mean score of items loading on components and gender, age, self-reported dominant personality trait, pet ownership, zoo

membership, and whether they would consider joining a zoo/conservation charity in the future. All analysis was conducted in SPSS version 21.

2.7. Results

2.7.1. Principle Component Analysis (PCA)

Given the exploratory nature of the analyses, a PCA with orthogonal rotation (varimax) was conducted on the 12 items from the questionnaire across all locations (Online, Edinburgh Zoo and Blair Drummond Safari Park). The Kaiser-Meyer-Olkin (KMO) measure (0.70) verified the sampling adequacy for PCA analysis. All KMO values for individual items were > .56, which is above the acceptable limit of .5 (Field, 2009).

Bartlett's test of sphericity X^2 (66) = 1028.329, $p < .001$, indicated that correlations between items were acceptable. A Monte Carlo simulation suggested retaining four components, and a Parallel Analysis indicated that the first three components (explaining 43.9% of the variance) had eigenvalues that exceeded chance levels. However, a scree plot suggested that only the first two components (explaining 34.2% of variance) be retained. The interpretation of item loadings for the two, three and four component solutions indicated that a two-component solution was the most appropriate and is therefore used in all subsequent analyses (Table 1). The two components were labelled in relation to Kellert's (1979a) classification of attitudes to animals. Component 1 resembled Naturalistic attitudes, which refers to interest and affection for wildlife and nature, and Component 2 resembled Humanistic attitudes, which refers to interest and affection for individual animals e.g. pets, and animals that have anthropomorphic characteristics e.g. chimpanzees.

Table 2.1. *Questionnaire investigating attitudes to chimpanzees and conservation, with a summary of PCA (varimax) two component solution. The highest component loading for each item is highlighted in bold.*

Questionnaire Item	Mean score (SD)	Naturalistic	Humanistic
I take an interest in wildlife wherever I am[1]	4.04 (.79)	.**710**	.298
I support the use of animals for experimental medical research that benefits humans*[2]	3.85 (.83)	**.703**	-.80
I always think about how my actions affect the environment[1]	3.82 (.81)	**.671**	.096
I would prefer to watch a documentary about chimpanzees in the wild than see them in the zoo*[2]	3.79 (.87)	**.647**	-.055
Some species are just meant to die out or become extinct* [2]	3.83 (.85)	**.355**	.247
I am confused about what is good and what is bad for the environment*[2]	3.34 (1.14)	-.099	**.652**
I am very interested in learning about the social lives of chimpanzee groups[2]	4.25 (.75)	.211	**.638**
I think zoos can play an important role in education and conservation[2]	4.31 (.70)	.151	**.591**
I dislike the smell of chimpanzees*[2]	3.73 (1.2)	-.058	**.464**
I am very aware of environmental issues[1]	3.90 (.73)	.393	**.430**
I do not think chimpanzees are entertaining to watch*[2]	4.10 (1.04)	.031	**.267**
I think a lot about the suffering of animals [1]	3.35 (.88)	.081	**.208**

* Indicates reflected items; [1] from Powell and Bullock, 2014; [2] from Lukas and Ross, 2005

2.7.2. Analysis of Experimental and Control Conditions

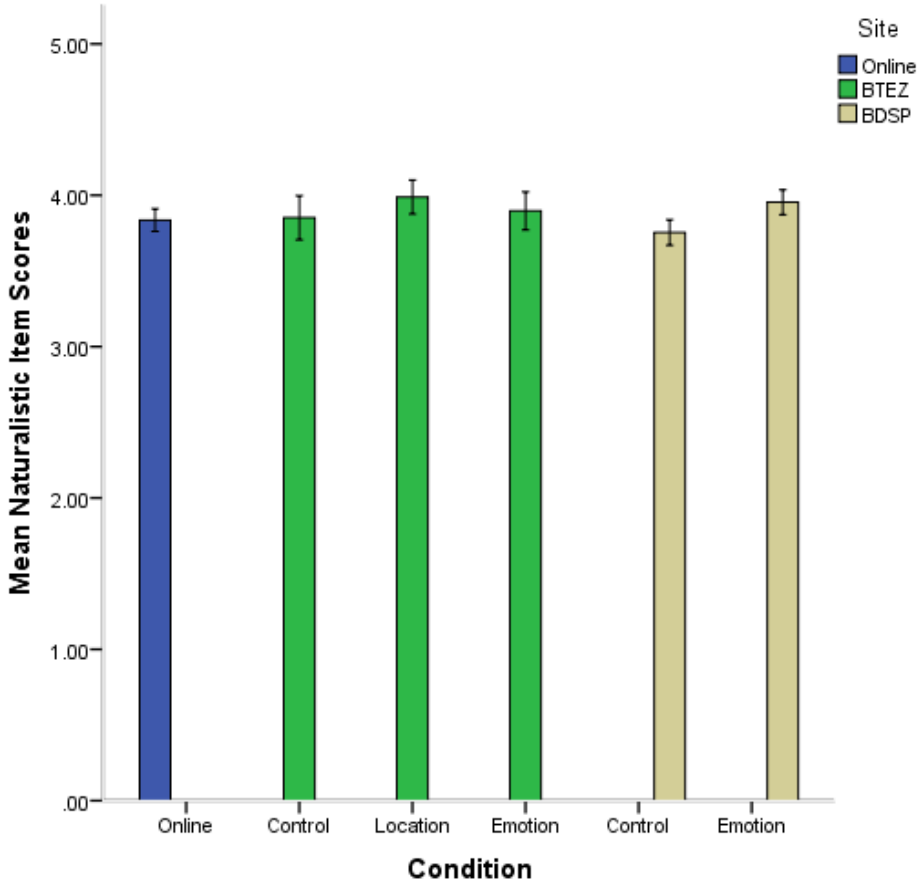
A one-way ANOVA was conducted to compare Component 1 (Naturalistic) and Component 2 (Humanistic) attitudes across six conditions; three at BTEZ (Emotion enhancement, location task, standard interpretation), two at BDSP (Emotion enhancement and standard interpretation) and the Online control condition (no zoo visit).

2.7.3. Naturalistic

There were statistically significant differences between conditions for mean scores of items loading on this component as determined by one-way ANOVA, F (5,708) = 2.372, p = .038 (see Figure 1). A Hoechberg's GT2 post-hoc test showed that at BDSP, Emotion Enhancement mean scores were significantly higher than the Control Condition at the same location, p = .034.

Multiple regression (with enter method), indicated that 17% of the variation inNaturalistic attitudes was attributed to the independent variables included in the model (F (17, 391) = 4.665, p = .001, with an R^2 of .169). A statistically significant positive association was found between Pet Ownership and Naturalistic Attitudes (β = .370, p = .001), as well as Neuroticism and Naturalistic attitudes (β = .180, p = .049). A negative, significant association was found between Agreeableness and Naturalistic attitudes (β = -.172, p = .018).

Figure 2.1. *Bar graph (with 95% CI) representing the mean scores for each condition for Naturalistic attitudes.*



2.7.4. Humanistic

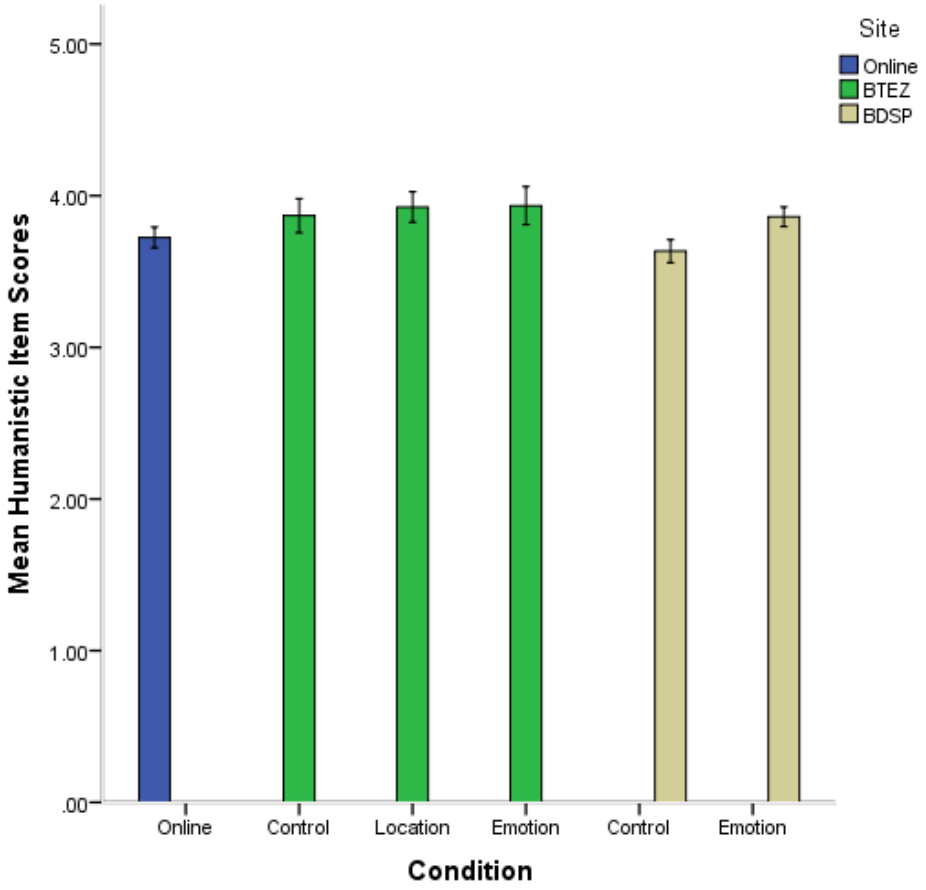
Humanistic scores differed between conditions (one-way ANOVA F (5,708) = 8.041, p = .001). A Hoechberg's GT2 post-hoc test indicated that at BDSP, those in the Emotion Enhancement Condition had higher mean score than the Control condition at the same location (p = .046) and the Online Condition (p = .003). At BTEZ, the Emotion Enhancement and Location conditions led to higher mean scores on the Humanistic component than the Online condition (both p = .001), and the Control condition at BDSP (Emotion enhancement, p =.010, Location p = .002). The Standard Interpretation condition at BTEZ led to significantly higher scores than those in the Online condition (p = .019) but did not significantly differ from either Emotion Enhancement or Location at the same site.

Multiple regression (with enter method), showed 13% (R^2 = .127) of the variation in Humanistic attitudes were attributed to the independent variables (F (17, 391) = 3.358, p = .001). A statistically significant positive association was found between Pet Ownership and Humanistic attitudes (β = .155, p =.003), as well as Zoo Membership and Humanistic attitudes (β = .180, p =.001). Both Neuroticism (β = .189, p = .029) and Agreeableness (β = .142, p = .041) were statistically significantly positively associated with Humanistic attitudes. No other statistically significant associations were found.

Donation Choice

No significant association was found between the three BTEZ conditions and hypothetical donation to chimpanzee conservation (N = 93), Scottish wildcat conservation (N =11), or donate to neither charity (N = 22), X(4) = 5.052, p = .282, therefore condition did not impact donation choice. However, Naturalistic (but not Humanistic) attitudes differed between those making a hypothetical donation to chimpanzee conservation, Scottish wildcat conservation, or neither, (one-way ANOVA, F, (2,123) = 3.247, p = .042). A Hoechberg's GT2 post-hoc test showed that Naturalistic attitudes were significantly higher in those choosing to donate to Scottish wildcat conservation, p = .037, than chimpanzee conservation, p = .108 or neither, p = .598.

Figure 2.2. *Bar graph (with 95% CI) representing the mean scores for each condition for Humanistic attitudes.*



2.8. Discussion

It is imperative that zoos develop effective conservation education in zoos, and to achieve this we need to understand how visitor engagement with interpretation influences their attitudes to conservation. Our results suggested there were differences in baseline attitudes at BTEZ, Humanistic scores were higher for those in the standard interpretation condition (and location and emotion conditions) than the online condition. The introduction of the emotion enhancement task at BDSP did impact upon both Naturalistic and Humanistic attitudes. Although the differences between conditions were small (see Figures 1 and 2), this finding provides some support for previous research that suggested emotional responses towards animals could be an important factor in conservation learning (Luebke, Watters, Packer et al, 2016; Myers, Saunders and Birjulin, 2004; Myers and Saunders, 2002; Powell and Bullock, 2014; Hayward and Rothenberg, 2004).

No differences for Naturalistic and Humanistic attitudes were found when comparing the Control Condition at BDSP and the Online Control Condition. This suggests that visiting BDSP had no discernible impact on attitudes unless visitors took part in the Emotion Enhancement task. Therefore, supporting previous research from Kellert and Wilson (1993) that suggested zoo visitors may be predisposed to have more affection and care for animals than the wider public. At BTEZ, there were no significant differences in either Naturalistic or Humanistic scores between the three conditions. Emotion, location and standard interpretation conditions resulted in significantly higher scores than online only participants, suggesting visiting BTEZ did have a positive impact on Naturalistic and Humanistic attitudes irrespective of condition. Previous research has found that increased animal activity enhances positive visitor experiences in zoos (Altman, 1998; Anderson et al, 2003). Activity could have contributed to variation between facilities, for example, the larger chimpanzee group at BTEZ could have resulted in visitors observing more social interactions, which may have resulted in a more engaging visitor experience irrespective of condition.

The Emotion Enhancement task consisted of being assigned a chimpanzee, similar in personality and sex as the visitor, and collecting observational behaviour on 'their' chimpanzee. The basis for this idea was the "similarity principle", which suggests similarity positively influences attitudes and perception of species, can strengthen emotional bonds and create a sense of identity with them (Gunnthorsdottir, 2001; Jacobs, 2009; Plous, 1993). Additionally, assigning a name to an animal has been shown to improve knowledge retention (Newberry, Fuhrman and Morgan, 2017). Charismatic animals, such as chimpanzees, have been shown to positively influence donations irrespective of their conservation status (Colleony, Clayton, Couvet et al, 2017). Both the emotional enhancement task and higher Humanistic attitudes would be expected to be associated with choosing to donate to chimpanzee conservation, as this attitude type is specifically related to an interest and affection for individual animals. However, there was no association between Humanistic attitude and choice of conservation donation. Interestingly, there was an association between positive Naturalistic attitudes and donation to Scottish wildcat conservation; informing visitors about the plight of the Scottish wildcat was a prominent funding campaign at Edinburgh Zoo at the time of data collection and this help may explain this result, or those with more Naturalistic attitudes may be more sensitive to local conservation issues. However, this highlights a key challenge in the evaluation of zoo conservation education: general attitudes (e.g. towards

conservation) may not be closely associated with behaviour specific (such as subsequent donation to chimpanzee conservation; e.g. Azjen's Theory of Planned Behaviour, 1985).

In line with several previous studies, our results indicate that both visitor characteristics and experiences at the exhibit can influence self-reported attitudes to animals and conservation (Kellert and Berry, 1987; Paul and Serpell, 1993; Milfont and Sibley, 2012). Visitor factors included pet ownership, zoo membership and personality traits (Neuroticism and Agreeableness), but not age and gender. It was expected that pet ownership would have a positive effect on Humanistic attitudes, given that this attitude is characterised by an interest and affection for individual animals with anthropomorphic features such as chimpanzees (Kellert, 1976). However, our results suggest that pet ownership also had a positive impact on Naturalistic attitudes (interest and affection for wildlife and nature) which supports findings that early childhood experiences with pets can help maintain a connection with nature (Paul and Serpell,1993).

The self-reported dominant personality trait Neuroticism had a positive association with both Humanistic and Naturalistic attitudes, although this result does not provide support for Milfont and Sibley (2012) who suggested Neuroticism is not strongly associated with environmental engagement. Agreeableness was positively associated with Humanistic attitudes and negatively associated with Naturalistic attitudes. While the measure of visitor personality used was very crude (asking participants to identify their most dominant trait), these findings nonetheless indicate that personality factors influence conservation attitudes and should be the focus of further research (Milfont and Sibley, 2012). Visitors who rated themselves highly on Neuroticism could be more worried about negative outcomes) and their concerns could reflect their anxiety about nature, wildlife, and individual animals. While previous research shows that age influences knowledge about great apes and conservation in zoo visitors (Lukas and Ross, 2005), this may not be a significant factor in determining emotional responses to zoo animals (Johnston, 1998). Kellert and Berry (1987) reported gender was the most important demographic influence on attitudes to animals, zoo visitor studies have also found stronger emotional responses in female than male visitors (Myers et al, 2004; Powell and Bullock, 2014), but we did not identify any gender effects on attitudes in the current study.

Overall, given the potential complexity of factors shaping zoo visitor experiences and motivation to engage in conservation learning, further research is necessary to develop suitable

methods and evaluation tools, and to contribute to the currently limited evidence base available to inform best practice within zoo conservation education.

2.9. Summary

Human attitudes towards other animals are multi-faceted and can be influenced by animal traits (such as their aesthetic appeal), by individual human attributes (such as gender) and contextual factors (such as interpretation and exhibit design). Understanding the factors influencing our attitudes to other species contributes to effective educational engagement and is important for promoting welfare and conservation. Overall, the findings of this research suggest that having a more personalised animal experience could enhance attitudes to conservation, although visitor characteristics and contextual factors are also important.

3. Impact of Interpretation Content on Attitudes to Great Ape Conservation and Welfare

Abstract

Understanding how visitors engage with interpretation is necessary to develop effective zoo conservation education but there has been limited study of the potential impact of both context and type of information presented to visitors.This online study investigated whether providing participantswith information regarding primate social behaviour (N = 67) in interpretation was more successful at enhancing attitudes to great ape conservation and welfare, than information regarding physical information (standard zoo interpretation, N = 58), or the role of zoo keepers and husbandry (N = 59).Time spent reading the content was recorded and participants rated the contents for relevance and engagement; participants in the Physical condition reported the slide as most relevant ifused in a zoo, whereas those in the Social condition rated the slide most engaging and spent more time reading it than those in either the Physical and Husbandry conditions. Attitudes to conservation were then assessed using a 16-item questionnaireand time spent reading (N = 49). Principle component analysis of attitudes identified three components (Naturalistic, Humanistic and Utilitarian) but no statistically significant

differences in component scores were found between the three conditions. A subset of participants (N = 61) were also randomly allocated to view either a summary of a positive or negative zoo incident before being asked to rate their agreement with four items regarding captive and wild great ape conservation and welfare. However, there was only a statistically significant association between the negative condition and participants' familiarity with the incident.Finally, level of interest in great ape conservation was measured by recording whether a subset of participants followed a link to view a relevant charity website (N = 52). The findings of this study suggest that although self-reported attitudes were not influenced by condition, ratings of engagement and time spent reading interpretation varies according to the type of information provided, which may have important implications regarding interpretation in the zoo context.

3.1. Introduction

Zoos are centres of research, education, conservation and entertainment (EAZA, 2016). The requirements for zoos is to not only adhere to their research, education and entertainment goals, but also provide empirical evidence that they have a positive impact on visitor attitudes to conservation. With visitors primarily motivated to attend zoos for purposes of recreation and entertainment (Morgan and Hodgkinson, 1999), understanding the impact of interpretation on visitor conservation attitudes is vital to develop effective conservation education. While zoos aim to promote care and concern for animals, and inspire conservation action, there is limited evidence that they achieve these goals.

Previous research found that 94% of zoo visitors stated that zoos' highest priority should be a place for visitors to learn about animals (Roe et al, 2014). The most common way for zoos to offer conservation education is to provide informative signs about the species and their natural habitat at the exhibit. Research suggests that more naturalistic exhibits have a positive impact on visitor attitudes to animals (Ross and Lukas, 2015; Clayton et al, 2009), as well as increasing time spent observing the animals, social interactions and animal-related conversations (Bitgood et al, 1988; Wood, 1998). Lukas and Ross (2005; see Table 1.1 for summary of attitude types from Kellert, 1980) investigated visitors' knowledge of, and attitudes towards chimpanzees and gorillas. Lukas and Ross (2005) found visitors exiting the exhibit achieved a 60% higher mark on knowledge questions regarding chimpanzees and gorillas than those entering the exhibit. They also found that first time visitor attitudes to conservation were less positive than visitors who had frequented the zoo more than once.

Lukas and Ross (2005) found the general attitude towards chimpanzees and gorillas was Naturalistic (interest and affection for wildlife), and the least common was Utilitarian (concern for the practical value of animals and their habitats (Kellert, 1980).

Immersive exhibits have been shown to satisfy the visitors need for an enjoyable experience, while providing opportunities for them to engage with interactive educational exhibits. For example, Swanagan (2000) found that viewing elephant training led to more visitors returning petitions about elephant conservation than when there was no interactive display. Similarly, Dotzour et al (2002) found that visitors who played a pro-environmental interactive game were four times more likely to pick up a 'save the earth' brochure, than those who did not play the game. Swanagan (2000) and Dotzour et al (2002) used behavioural change as a measure to assess attitudes to conservation, behavioural indicators may be as informative as questionnaires but do not measure knowledge or provide detail on types of attitude. Measuring visitor dwell time at exhibits is often used to establish visitor engagement, for example, Bowler et al (2012) measured visitor dwell time to investigate whether visitors were interested in and engaging with a new primate research centre within a zoo, which featured a visible scientist working with the primates on cognitive tasks. The results suggested that visitor engagement with interpretation was 55.7% higher when a scientist was observed working with the primates, compared with 16.9% when there was no research activity visible. Bowler et al (2012) provide an important starting point for understanding how visitors use exhibits, which can have important implications for exhibit design. They also provided evidence that zoos visitors do show interest in research activities, although knowledge retention and attitude change was not measured.

In addition to exhibit design, research suggests that visitor characteristics, such as gender, affects attitudes to animals (Driscoll, 1992; Erlanger and Tsytsarev, 2012; Hills, 1993; Kellert and Berry, 1987). In a large attitudinal survey in the United States, Kellert (1984) found male children were more knowledgeable about an animal's biological characteristics, whereas female children showed more affection towards animals. Similarly, Kellert and Berry (1987) found adult women expressed stronger emotions towards individual animals than adult males. Paul (2000) found females and pet owners (past and present) showed a higher level of empathy, than males and non-pet owners. Powell and Bullock (2014) found a relationship between zoo visitors' liking for nature and conservation, and those who reported strong emotional connections to animals. Both Paul (2000) and Powell and Bullock (2014) found women reported stronger emotional responses than men.These findings suggest it may be

important to considera variety of approaches to interpretation in order to engage diverse zoo visitors.

Research discussed has examined the impact of zoo interpretation (enclosure design and signage) and visitor variation (gender and pet ownership) on perception and attitudes, however, there has been less consideration of the potential impact of the form of information provided, in terms of type of information and contextual framing. Previous research suggests that as social animals, human beings are more interested in social relationships than physical information (Dunbar, 2011). There has been no research investigating whether providing information regarding primate social behaviour in zoo interpretation impacts visitor attitudes to conservation. Highlighting social dimensionsmay be important in shaping emotional responses to animals, and emotional connection has been shown to impact on conservation attitudes (Powell and Bullock, 2014) and likelihood of donating to conservation (Swanagan, 2000).

The use of images is also likely to be an important component of interpretation, but this also requires careful consideration. For example, participants who viewed a photo of a chimpanzee in the presence of a human were 35.5% more likely to state that wild chimpanzee populations were stable, compared with those viewing the same photo without a human present (Ross et al, 2011). These findings were replicated for participants viewing images of other primate species (capuchin, lemur and squirrel monkey); human presence and an office setting impacted negatively on perceivedconservation status compared to no human present and a naturalistic background (Leighty et al, 2015). The results indicate that viewing a non-human primate in company with a human increases the likelihood of perceiving the animal as not vulnerable to extinction, and this also correlated with a greater wish to keep the non-human primate as a pet. Similarly, comments from viewers after watching a Youtube video of a human ‘tickling’ a slow loris were analysed and 25% of viewers wanted to keep a slow loris as a pet, however, when information about their conservation was added, this dropped to 10% (Nekaris et al, 2013), therefore showing the importance of the context of information and how it can be perceived.These findings have important implications for interpretation and public relations in zoos. For example, when an infant non-human primate needs to be hand-reared by a keeper in a zoo or sanctuary, pictures of cross species interactions are often published on websites or on the news and could potentially have a negative impact on perceptions of conservation status.

Overall, there is a limited evidence base on the efficacy of zoos in promoting conservation to visitors. Different studies within different zoos involve variations in visitor characteristics,

exhibit designs, species and research methods, all of which could impact upon the generalisation of results. In addition, the efficacy of interpretation has been studied using several measures. For example, time spent at an exhibit (dwell time) indicates interest or engagement with the animals orexhibit (Bowler et al, 2012), while the time spent reading signage has been used as a more direct measure of visitor engagement (Ross and Lukas, 2005). Self-reported measures are a common way for zoo researchers to assess learning outcomes or attitudinal change but there are limitations, for example, response bias which refers to the tendency of participants to respond to questions untruthfully (Hyman, 1954), and behavioural measures are rarely used to validate self-reported attitudes in zoo visitors.

This study was conducted online to avoid confounding variables (e.g. different exhibits, interpretation and animal activity levels in a zoo context)which may influence the data.I investigated whether the form of information (Social, Physical or Husbandry) provided can influence attitudes to great ape species and zoos, and whether self-reported attitudes are validated by behavioural measures of time spent reading information and subsequent interest in related charities.Ihypothesised that participant attitudes to great ape conservation and welfare would be more positive after viewing Social information, and participants would rate the Social information as most engaging and most relevantfor zoo signage. Physical information was included to reflect more standard interpretation content for zoo signage. The Husbandry condition highlighted the human-animal interaction in the lives of captive apes and was based on Ross et al (2008), the focus on great apes in relation to human activity might be expected to reduce perceived conservation risk. Previous research indicates that females show more emotional responses to animals and males engage more with an animal's biological characteristics (Kellert, 1984), therefore, I hypothesised that females would show more positive attitudes than males.In addition to informational content and images, narratives such as in the media, or those anecdotes commonly provided by keeper talks and zoo volunteers about individual animals or groups, may also be important in shaping attitudes. It is not known whether zoo incidentswidely covered in the media (e.g. gorilla shot after child entered exhibit at Cincinnati Zoo) impact on attitudes to zoos and captive animals, but exemplar cases are used to examine the role of narrative context on perceptions. Previous research has suggested that video and photographic representation of primates can impact people's attitudes towards their welfare and conservation (e.g. Ross et al, 2011; Leighty, et al, 2015; Nekaris et al, 2013).Therefore, it is expected that participant attitudes will differ following exposure to either

a negative or positive zoo incident, with those reading about a positive incident reporting more positive attitudes towards great apes and zoos.

3.2. Methodology

Participants: A total of 184 participants (123 females and 61 males) aged between 18 and 74 were recruited to participate in an online study (between December 2017 – February 2018), via advertisements on the university website and social media. Participants were randomly allocated to a Social Condition (67 females and 21 males, age M = 33.1, SD = 10.6), Physical Control condition (58 participants, 34 females and 24 males, age M = 34.8, SD = 12.4), and a Husbandry Condition (59 participants, 43 females and 16 males, age M = 29.4, SD = 9.7).

Ethics: Consent was gained, with participants informed about the nature of the study and that participation was voluntary and they could withdraw at any time. One section included material which could potentially cause distress; at the start of this section, participants were provided with information regarding the upcoming content and given the opportunity to omit the section.

3.2.1. Procedure

Participants were invited to complete a 10-minute online studyinvestigating attitudes to great ape conservation and welfare. The study was designed and delivered using Qualtrics (Provo, UT). The design was between-subjects, with participants randomly allocated to one of three conditions; Social information, Physical informationor Husbandry. Each participant viewed three slides with images and information (the length of text was the same on each slide) about gorillas, orangutans and chimpanzees, presented in turn. After each slide,participants were asked to rate on a 5-point Likert scale, i) how effective it was in engaging their interest, and ii) how relevant they think this interpretation would be in a zoo setting. After allthree slides had been rated, participants were asked how interested they would be in both visiting a zoo and becoming a zoo member. They were also asked to rank the three species in terms of their similarity to humans. Participants then completed a 16-item questionnaire (using a 5-point Likert scale) designed to assess attitudes to great ape conservation and welfare attitudes (see Table 3.1).

In the third section of the study, some participants were randomly allocated to one of two conditions and presented with either a photo and brief description of a positive or negative incident involving humans and great apes in a zoo context. Participants were asked to rate their agreement (on a five-point Likert scale, strongly disagree – strongly agree) withthe following statements: “I am familiar with the story”, “I think watching great apes in zoos is entertaining”,

"I am concerned about the welfare of captive great apes" and "It is important to conserve great apes in their natural habitats".

At the end of the study, participants were given the opportunity to find out more about great ape conservation. A link to the conservation section of relevant organisation was provided for each of the three species included in the study: Jane Goodall Institute (chimpanzees), the Gorilla Fundand the Orangutan Foundation.

The length of time that participants spent reading each interpretation slide and choice to visit a related charity was recorded to triangulate self-reported attitudes to interpretation content, attitudes to welfare and conservation.

3.2.2. Materials

Attitudes to Great Apes and Conservation

A short (16 item) questionnaire was used to measure attitudes to great apes and conservation (Table 3.1). A five-point Likert scale was used for participants to rate their agreement to each statement (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, and Strongly Disagree). Items were all selected and adapted from questionnaires previously developed to examine attitudes to great apes and conservation (Paul, 2000; Lukas and Ross, 2005; Powell and Bullock, 2014). N = 7 were selected and reworded from the attitudes towards great apes subscale of Knowledge and Attitudes towards Gorillas and Chimpanzees questionnaire developed by Lukas and Ross (2005), N = 4 from the Predisposition subscale of Powell and Bullock's (2014) study and N = 5 from Paul's (2000) Animal Empathy subscale. Lukas and Ross' (2005) questionnaire knowledge and attitudes towards great apes contains 28 items, and I selected 7 itemsfrom the Knowledge and Attitudes towards Gorillas and Chimpanzees subscale to assess attitudes to great apes, zoos and conservation. Lukas and Ross's (2005) factor analysis of zoo visitors' attitudes towards great apes revealed six components (Naturalistic, Ecologistic, Moralistic, Negativistic, Utilitarian, Dominionistic and Humanistic), which revealed a partial replication of Kellert's (1979) 10 categorisations of human attitudes to animals (Table 1.1). Three items were adapted from the Predispositions to Animals and Nature subscale of Powell and Bullock's (2014) questionnaire on conservation mindedness, predispositions (attitudes) to animals and nature, and emotional response to a zoo exhibit. Powell and Bullock's (2014) items were all positively phrased, and two items were therefore reworded to avoid an acquiescence bias, and these items were then reverse scored for analyses.

3.2.3. Statistical Analysis

Five participants were excluded from the analysis because more than three items were missing on the slide ratings or attitude questionnaire. Due to human error, not all participants' responses were recorded resulting in a reduced sample available for related analyses in the zoo incident section (N = 61) and link to a charity of interest (N = 52).

Participants' ratings of engagement and relevance of slides and time spent reading (in seconds) were averaged across the three slides presented. As data were non-parametric a Kruskal-Wallis test was used to compare overall means between conditions. When an overall difference was identified, Mann Whitney U tests were used to examine group differences using Bonferroni corrections for multiple comparisons. Planned comparisons examining perceived similarity to each species and level of interest and engagement ratings for slides by species could not be conducted due to human error in study design. To facilitate interpretation ofAttitudes to Great Apes and Conservationquestionnaire items all negative items on the questionnaire were reverse scored prior to analyses. A principle component analysis (PCA) was used to identify a reduced number of uncorrelated variables from the data set.

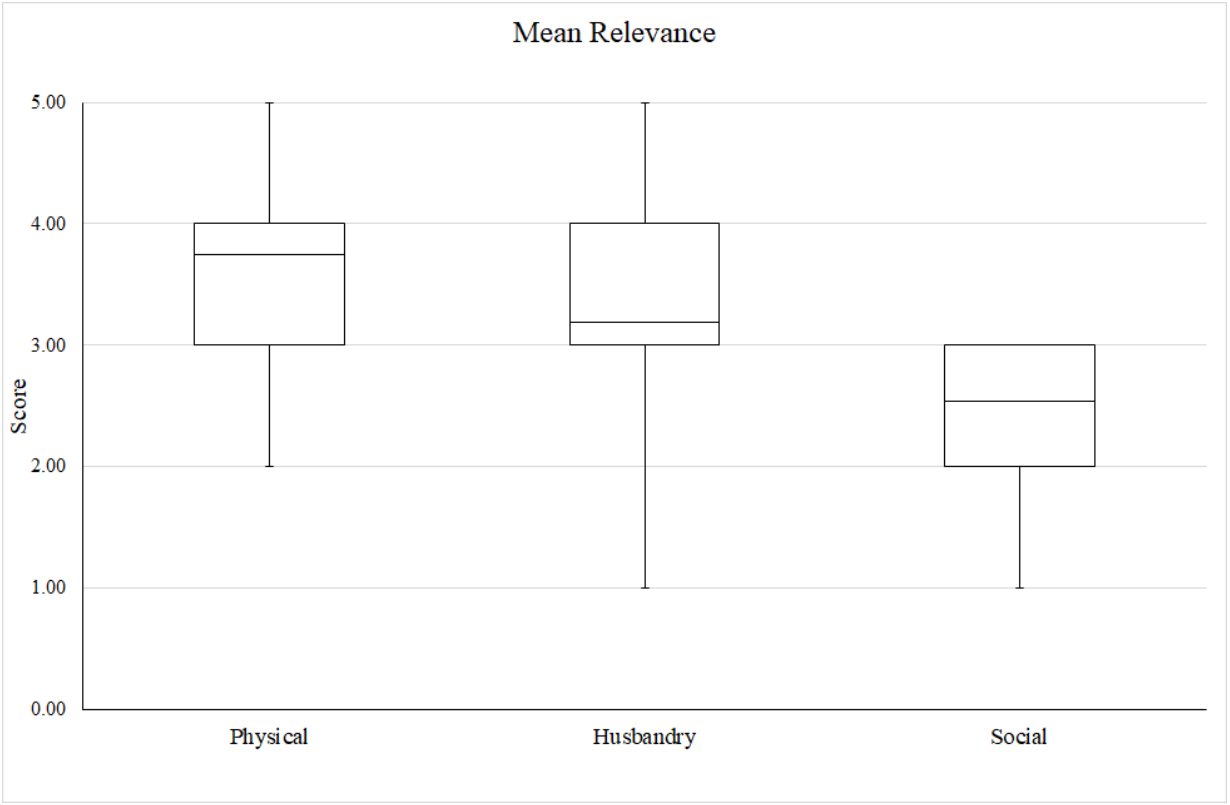
As data were non-parametric, a Kruskal-Wallis test and Mann Whitney tests were used to explore differences between mean scores on the components extracted across conditions (Social, Physical and Husbandry). Mann-Whitney U tests were used to compare zoo incident condition (positive or negative) and responses to the four related items. Finally, motivation to visit a related conservation charity website was scored using first response only and a Mann-Whitney test was used to establish whether an association existed between attitudes and condition to visit the charity website.

3.3. Results

Ratings of Interpretation Content:

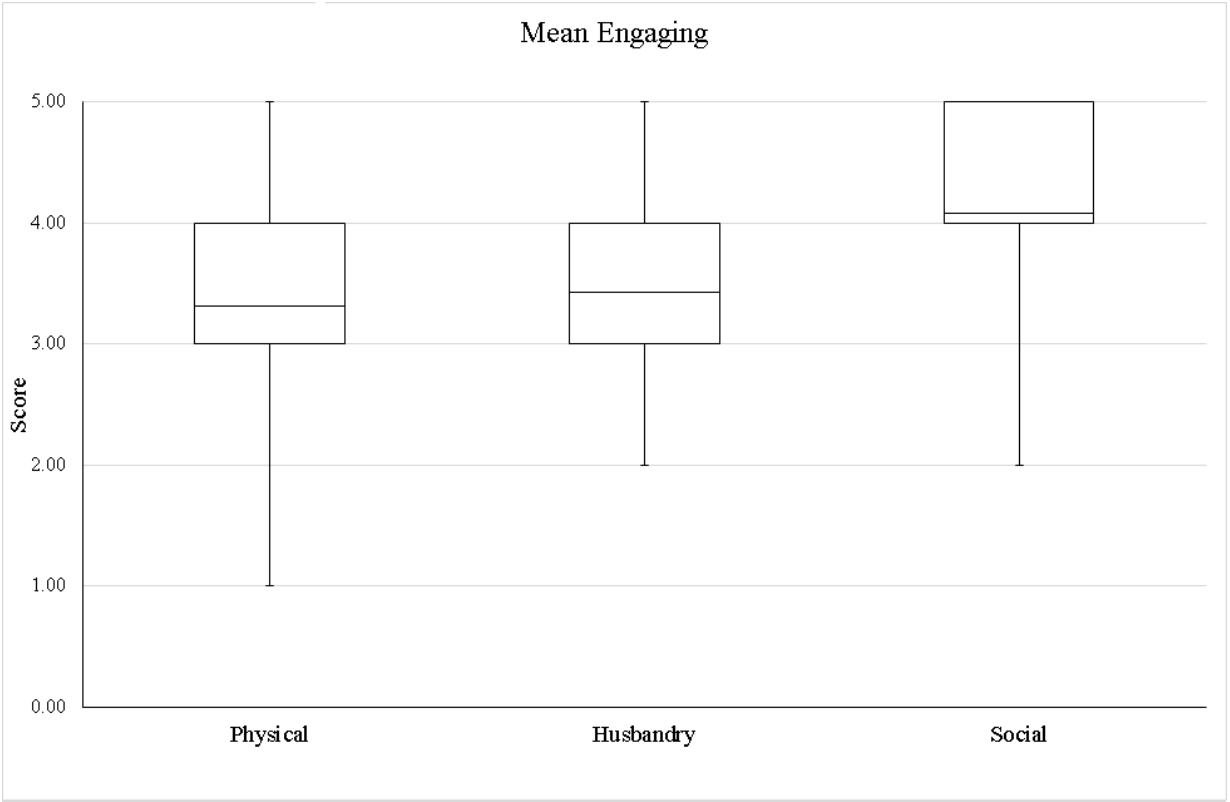
A Kruskal-Wallis test showed there was a statistically significant difference between mean relevance of slide scores according to condition, $X^2(2) = 11.762$, $p = .003$, with Mann Whitney U tests indicating statistically significant differences (see Figure 3.1) were found for the Husbandry (Mn = 3.19, Mdn = 3.00, IQ range = 3.00-3.91) and Physical conditions (Mn = 3.75, Mdn = 4.00, IQ range = 3.00-4.00; Z = -3.432, p = .001). There were no differences between mean relevance of slides for those in the Social (Mn = 2.54, Mdn = 3.00, IQ range = 2.00-3.00) and Physical conditions (Mn = 3.75, Mdn = 4.00, IQ range = 3.00-4.00; Z = -1.273 , p = .203), or between Social (Mn = 2.54, Mdn = 3.00, IQ range = 2.00-3.00), and Husbandry (Mn = 3.19, Mdn = 3.00, IQ range = 3.00-3.91; Z = -1.986, p = .047) conditions.

Figure 3.1. *Box plot illustrating differences in self-reported ratings of mean relevance (of the slide if it were used in a zoo) across conditions; physical, husbandry and social. The median line represents the mid-point of the data set.*



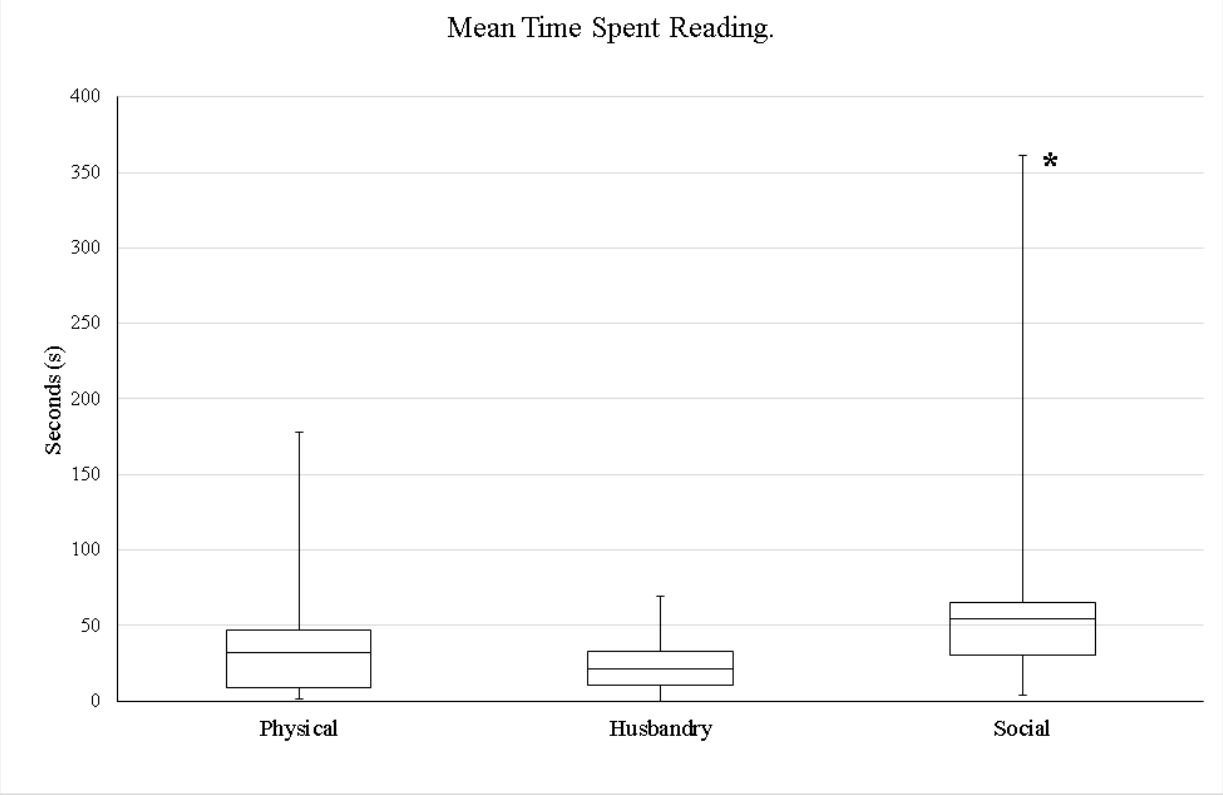
A Kruskal-Wallis test showed there were statistically significant differences in how engaging participants found the interpretation according to condition ($X^2(2) = 17.533$, $p = .001$), with Mann Whitney U tests indicating (see Figure 3.2) that those in the Social condition (Mn = 4.08, Mdn = 4.00, IQ range = 3.41-5.00) found the contents more engaging than those in the Husbandry condition(Mn = 3.42, Mdn = 3.33, IQ range = 3.00-4.00; Z = -3.324, p = .001) and Physical condition (Mn = 3.31, Mdn = 3.33, IQ range = 2.50-4.00; Z = -3.904, p = .001). There were no statistically significant differences for those in the Husbandry (Mn = 3.42, Mdn = 3.33, IQ range = 3.00-4.00) and Physical conditions (Mn = 3.31, Mdn = 3.33, IQ range = 2.50-4.00; Z = -8.16, p = .414).

Figure 3.2.*Box plot illustrating mean differences in self-reported ratings of how engaging the slides were across conditions; physical, husbandry and social. The median line represents the mid-point of the data set.*



Participants also differed in the mean time spent reading according to condition ($X^2(2)$ = 16.971, p = .001) with Mann Whitney U tests indicating (see Figure 3.3) that those in the Social condition (Mn = 54.11, Mdn = 45.33, IQ range = 33.17-66.18)spent more time reading the slides, than those in the Husbandry condition (Mn = 21.50, Mdn = 20.43, IQ range = 14.92-29.25; Z = -4.175, p = .001), and Physical condition (Mn = 32.10, Mdn = 23.60, IQ range = 10.38-40.58; Z = -2.937, p = .003). No statistically significant differences were found for mean time spent reading in the Physical (Mn = 32.10, Mdn = 23.60, IQ range = 10.38-40.58) and Husbandry (Mn = 21.50, Mdn = 20.43, IQ range = 14.92-29.25; Z = -.849, p = .399) conditions.

Figure 3.3. *Box plot illustrating differences in the mean time spent reading (in seconds) for participants in the physical, husbandry and social conditions. The median line represents the mid-point of the data set, and the asterisk indicates a single outlier in the social condition data.*



3.3.1. Attitudes to Great Apes and Conservation

Given the exploratory nature of the analyses, a PCA with orthogonal rotation (varimax) was conducted on the 16 items from the questionnaire. The Kaiser-Meyer-Olkin (KMO) measure (0.78) verified the sampling adequacy for PCA analysis. All KMO values for individual items were > .78, which is above the acceptable limit of .5 (Field, 2009). Bartlett's test of sphericity X^2 (120) = 637.260, p = .001, indicated that correlations between items were acceptable.

A Parallel Analysis indicated that the first two components (explaining 37.4% of the variance) had eigenvalues that exceeded chance levels, while the scree plot suggested retaining the first three components (explaining 46.2% of variance). The interpretation of item loadings for the two and three component solutions also indicated that a three-component solution was the most appropriate and is therefore used in all subsequent analyses (Table 3.1). The three components were labelled in relation to Kellert's (1976) classification of attitudes to animals:

- Component 1 represented Naturalistic (conservation) attitudes, which refers to interest and affection for wildlife and nature.
- Component 2 indicated Humanistic (concern for animals) attitudes, which refers to interest and affection for individual animals e.g. pets, and animals that have anthropomorphic characteristics e.g. great apes.
- Component 3 indicated Utilitarian (zoos) attitudes, which refers to concern for the practical value of animals and their habitats.

The mean scores for items loading on to extracted components were calculated to facilitate interpretation of data. "I think as long as they are warm and well fed, apes do not mind being kept in cages" was omitted as it did not meet the criteria (item loading on all components < .3).

Table3.1. *Questionnaire aimed at assessing attitudes to great apes and conservation, showing mean scores (and standard deviation) for each item, and PCA item loadings for Naturalistic, Humanistic and Utilitarian attitudes.*

Questionnaire Item	Mean Score (SD)	Naturalistic	Humanistic	Utilitarian
I have a good understanding of wildlife conservation issues.[1]	3.48 (.93)	**.812**		
I take an interest in wildlife wherever I am.[1]	4.33 (.80)	**.744**		
I engage in pro-environmental efforts during my daily activities (recycling, reducing energy usage etc).[1]	4.22 (.75)	**.679**		
I always think about how my actions affect the environment.[1]	4.02 (.73)	**.569**		
I am very interested in learning about the social lives of great ape groups.[2]	3.84 (.91)	**.519**		
I am confused about what is good and what is bad for the environment.[2] *	3.66 (.96)	**.336**		
I think a lot about the suffering of animals.[3]	3.86 (.85)		**.695**	
I get very angry when I see animals being ill-treated.[3]	4.56 (.64)		**.634**	
I support the use of animals for experimental medical research that benefits humans[2] *	3.52 (1.19)		**.634**	
I feel that animals have a great influence on my mood.[3]	4.02 (1.02)		**.617**	
I think people often make too much of the feelings and sensitivities of great apes.[3]*	3.86 (.85)		**.578**	
I think some species are just meant to die out or become extinct.[2] *	3.90 (1.17)		**.475**	
I would prefer to watch a documentary about great apes in the wild than see them in the zoo.[2] *	1.88 (.97)			**.700**
I think zoos can play an important role in education and conservation.[2]	3.91 (.96)			**.654**

I do not think great apes are entertaining to watch.[2] *	3.75 (1.01)		**.637**
I think as long as they are warm and well fed, great apes do not mind being kept in cages.[3] *	2.73 (1.32)	**.-192**	

*indicates reversed items;[1] Powell and Bullock, 2014. [2] Lukas and Ross, 2005. [3] Paul, 2000;

Naturalistic:A Kruskal-Wallis test showed there was a marginally non-significant difference between mean Naturalistic scores according to condition, $X^2(2) = 5.733$, p = .057, with those in the Social condition (Mdn = 4.10, IQ range = 3.90-4.40; Z = -2.335, p = .020) tending to have more positive attitudes, than those in the Husbandry condition (Mdn = 3.90, IQ range = 3.70-4.45; Z = -1.769, p = .077) or Physical condition (Mdn = 3.90, IQ range = 3.50-4.45; Z = -.598, p = .550). Mann-Whitney U tests showed no significant differences between Naturalistic scores according to participant gender (Male; Mdn = 3.91, IQ range = 3.50-4.33, Female; Mdn = 4.00, IQ range = 3.50-4.33, Z = -.641, p = .522), or between participants who chose to visit a conservation charity website at the end of the study (Visited; Mdn = 4.00, IQ range = 3.50-4.33, No Visit; Mdn = 3.66, IQ range = 3.04-4.20, Z = -.839, p = .401). A Spearman Rho correlation indicated a statistically significant positive relationship between Naturalistic scores and agreement with two statements following the presentation of the zoo incident content , "I am concerned about the welfare of great apes in captivity", $r_s = .370$, N = 137 , p = .001 and "it is important to conserve great apes in the wild", $r_s = .323$, N = 137, p = .001.

Humanistic:A Kruskal-Wallis test showed there were no statistically significant differences between Humanistic scores according to condition,$X^2(2) = .749$, p = .688. A Mann-Whitney U test indicated that female participants scored higher on Humanistic attitudes (Mdn = 4.16, IQ range = 3.83-4.50) than male participants (Mdn = 3.83, IQ range = 3.50-4.33; Z = -2.555, p = .011). A Mann-Whitney U test showed no significant differences between Humanistic scores and visit to a conservation charity website at the end of the study (Visited; Mdn = 4.00, IQ range = 3.66-4.50, No Visit; Mdn = 4.08, IQ range = 3.16-4.66, Z = -.271, p = .787). A Spearman's Rho showed a significant negative (and positive correlation) between Humanistic scores and two statements scored following the presentation of the zoo incident "watching great apes in zoos is entertaining", $r_s = -.180$, N = 135, p = .036, and a significant positive

correlation for the statement, “I am concerned about the welfare of great apes in captivity” and Humanistic scores, $r_s = .274$, $N = 135$, $p = .001$.

Utilitarian: A Kruskal-Wallis test showed there were no statistically significant differences between Utilitarian scores according to condition, $X^2(2) = .409$, $p = .815$. Mann-Whitney U tests showed no differences between participant gender (Male; Mdn = 3.33, IQ range = 2.66-3.66, Female; Mdn = 3.16, IQ range = 2.66-3.66, Z = -.034, p = .973), or those who did and did not visit the charity conservation website at the end of the study (Visited; Mdn = 3.33, IQ range = 2.66-3.91, No Visit; Mdn = 3.00, IQ range = 2.41-3.58). A Spearman's Rho showed a statistically significant positive correlation between Utilitarian scores and "watching great apes in zoos is entertaining", $r_s = .521$, N = 137 p = .001.

Zoo incident:A Mann-Whitney U test showed a statistically significant difference between the negative incident condition and familiarity with the story, U = 166.000, p = .002, r = .16. A Spearman's Rho showed a statistically significant negative correlation between the zoo incident statement "watching great apes in zoos is entertaining" and "it is important to conserve great apes in the wild", $r_s = -.240$, N = 137, p = .005. A Spearman's Rho showed a statistically significant positive correlation between "I am concerned about the welfare of great apes in captivity" and "it is important to conserve great apes in the wild", $r_s = .410$, N = 137, p = .001.

Charity Website Visit: For those with data recorded (N=66) most followed a link to the external charity website (N = 52, 78.7%). Mann Whitney U tests showed there were no statistically significant differences between choosing to visit a charity website and mean ratings of how relevant the interpretation was (Visit; Mdn = 3.66, IQ range = 3.00-4.00; Z = -1.337, N = 176, p = .181, No Visit; Mdn = 4.00, IQ range = 3.00-4.91), how engaging the interpretation was (Visit; Mdn = 3.83, IQ range = 3.00-4.83; Z = -.245, N = 176, p = .807, No Visit; Mdn = 3.66, IQ range = 3.00-4.50), and the mean reading time (Visit; Mdn = 27.22, IQ range = 16.09-45.42; Z = -.808, N= 66, p = .419, No Visit; Mdn = 26.02, IQ range = 18.33 – 33.55).

3.4. Discussion

The task for zoos is to not only adhere to their research, education and entertainment goals, but also provide empirical evidence that they have a positive impact on visitor attitudes to conservation. Research in this area is needed to understand how interpretation impacts visitor conservation attitudes and inform effective conservation efforts that aim to educate the public of the threats to species and their habitats. The rationale for conducting this study online was to avoid the confounding factors of different exhibits, interpretation and animal activity levels in a zoo context. The results indicated that the type of content presented impacts on both visitor perceptions of relevance and for levels of engagement with interpretation. Participants considered Physical information to be more relevant than either Social or Husbandry, perhaps rated based on perceived similarity to standard zoo signage, although I did not collect data on frequency or recency of participants' zoo visitors to test this assumption. However, those in the Social condition rated their slide content as significantly more engaging and had a longer mean reading duration; the behavioural measure serves to validate the self-rated level of engagement. This result supports the hypothesis that humans are more likely to be interested in social relationships than physical information(e.g. Dunbar, 2011; Mesoudi et al. 2006), which seems also to be applicable to our interest in other species. Although Bowler et al (2012) used reading time as a measure but did not measure attitudes, our study supports the use of time spent reading as a proxy measure of interest or engagement.

Although condition influenced ratings and reading time for slides presented, between-condition differences were not found for attitudes (Humanistic and Utilitarian), indicating that attitudes are less subject to change in response to information provided. There was a marginally non-significant difference between conditions for the Naturalistic component scores, which were higher in the Social condition, suggesting that information type may exert a weak influence on conservation attitudes, but stronger evidence is required to evaluate this possibility. It was expected that Husbandry scores would be lower given the presence of the human in the image and content describing human-great ape interactions and this would result in a reduced perceived concern for conservation, as Ross et al (2008) found. Components extracted are similar for those examining zoo visitor attitudes to great apes and conservation (see Chapter 2), which indicates the online sample of participants in the present study have comparable attitudes to zoo visitors with generally positive scores. The current study added four items on empathy towards great apes (adapted from Paul, 2000), which loaded on the

Humanistic component. Contrary to the expectation that Social information would enhance emotional responses to great apes, the Social condition participants did not score higher on this Humanistic component. However, sampling bias could have impacted this as the main aim of the study was explained in the online link, therefore it is likely those with a predisposed interest in great ape conservation would have taken part and their attitudes were already positive.

Previous research indicates that emotional engagement can positively influence conservation learning (Myers et al, 2004; Powell and Bullock, 2014; Hayward and Rothenberg, 2004). This study lacked the animal component of zoo interpretation and presented static images rather than showing behaviour in videos. Engagement and attitudes may have been influenced by animal activity, as indicated by previous studies within zoos (Powell and Bullock, 2014), for example, social play (for Social condition), locomoting or eating (for Physical condition) or Keepers engaged in animal training may have enhanced participants' emotional responses to the content presented. Gender had a positive influence on only Humanistic attitudes, with female participants showing more positive attitudes than males, suggesting that females showed more interest and affection for individual animals such as great apes, therefore supporting previous research that found genderand empathy affects attitudes to animals (Driscoll, 1992; Erlanger and Tsytsarev, 2012; Hills, 1993; Kellert and Berry, 1987).

Earlierresearch found that a perceived emotionally engaging animal experience leads to positive behavioural responses, such as the returning of petitions (Swanagan, 2000) or picking up a 'save the earth' leaflet (Dotzour et al, 2002). This study incorporated two behavioural measures: time spent reading interpretation and choice to visit a conservation organisation website. Unfortunately, data on website visits were only available for a subsample, but a high proportion of these (78.7%) demonstrated their motivation by following the link to learn more about great ape conservation. It would have also been interesting to measure the time spent viewing the conservation organisation website, or to record whether more than one site was visited, but this was not feasible given the software used.Perhaps a better behavioural measure would have been to ask participants to follow a link to sign an online petition to support conservation (Swanagan, 2000), which could provide a simple measure of participants' perceived self-efficacy in relation to engaging in pro-conservation actions.

Video and photographic representations of primates have been shown to influence people's attitudes towards their welfare and conservation (e.g. Ross et al 2011; Nekaris et al, 2013) but

there is no evidence on how media narratives of primates in zoos impacts upon attitudes to zoos, welfare or conservation. However, the only statistically significant difference for the incident condition was between thenegative incident condition and increased familiarity with the story, which is probably because the incident itself was several years more recent than the positive narrative presented. Correlational analysisrevealed a positive significant relationship between items following the incident condition that scored highly on "I am concerned about the welfare of great apes in captivity" as well as "it is important to conserve great apes in the wild" and Naturalistic attitudes, therefore suggesting participants are interested in and show affection for great apes and are concerned about their welfare and conservation. Those who scored highly on the Humanistic attitude reported not finding watching great apes in zoos entertaining, whereas those who scored highly on the Utilitarian attitude stated they would find watching great apes in zoos entertaining. Some of the items presented after the incident condition were similar to those on the attitudes to great apes and conservation questionnaire. Therefore, a Spearman's Rho correlation should have been used to investigate agreement between attitude scores (pre and post viewing of incident condition), and whether condition can influence changes. Further research should use a larger sample and investigate whether self-reported ratings such as those discussed above correlate with a behavioural measure such as finding out further information about volunteering at the zoo or becoming a member.

Enhancing visitor attitudes to conservation is a challenge as there are many factors (visitor characteristics, exhibit design and interpretation) which could impact the experience and how they engage with education (Erlanger and Tsytsarev, 2012; Hayward and Rothenberg, 2004; Lukas and Ross, 2009; Milfont and Sibley, 2012; Myers et al, 2004).The intervention used in the present study was brief, for further investigation a controlled study on interpretation within the zoo context would be beneficial, as previous research suggests emotionally engaging animal experiences have a positive impact of conservation learning (Myers and Saunders, 2002; Myers et al, 2004; Paul, 2000). The use of within participant pre-and-post measures would also be desirable to accommodate individual differences in visitor attitudes (e.g. Paul, 2000).

The present study has provided some evidence that participants find social information more engaging and this may be effective in zoo context, especially when combined with observation of live social interactions (e.g. Powell and Bullock, 2014). Simple behavioural measures are fair indicators of some aspects, such as reading time and engagement, but choice to visit conservation website was not related to differences in self-reported attitudes: creative

data collection methods are needed in zoo context, where visitors' primary motivation is most commonly entertainment and enjoyment (Morgan and Hodgkinson, 1999). However, these attitudes may relate to strong personal value systems which may be very difficult to influence, at least using one-hit or short-term interventions, such as a zoo visit. A more controlled evaluation of various components, such as interpretation content, are essential to enhancing our understanding of zoo visitor experiences and learning: a more robust evidence base is required to optimise the capacity of zoos to inform and educate their visitors about conservation.

4. Evaluating the Impact of an Animal Welfare and Conservation Education Programme on Teenagers' Attitudes to Animals and Conservation.

Abstract

Education is a core goal in zoos and includes engaging visitors in informal learning about nature and conservation and delivering formal learning opportunities, mostly to school- aged children. Although school trips are a key aspect of zoo education efforts, there has been limited research examining the impact of these activities on participants' learning outcomes and attitudes to conservation. Previous research has suggested school field trips to zoos are beneficial, with most measuring biological knowledge acquisition. In addition, they have largely focused on single hit conservation education facilitated during one-off zoo visits and there has been less consideration of how more intensive zoo education programmes impact on participants' knowledge and attitudes. To better understand how young people engage with learning opportunities at the zoo, a focus group methodology was used to examine the attitudes and experiences of teenage participants (N = 11 females, aged 14 to 17) following their attendance at an intensive week-long programme on welfare and conservation at a local safari park were examined. A 16-item questionnaire was also used to measure attitudes to conservation, animal welfare and emotion towards animals, and was used to aid in the

interpretation of the focus group data and allowed individuals to express attitudes in a confidential manner without the influence of group dynamics. A hypothetical donation task was used to examine participants' preferences for a welfare or conservation organisation. Thematic analysis of participants' responses indicated that there were four themes: attitudes to Conservation, attitudes to Welfare, acquisition of Knowledge, and Emotional experiences. The themes indicated that participants' most predominant attitude was Naturalistic (interest and affection for wildlife and habitats) and is congruent with previous attitudinal findings in Chapters 2 and 3. Participants were well-informed regarding conservation issues and positive in their conservation attitudes from the focus group. Emotion (Humanistic; affection for animals) was the least prominent theme, but emotive statements in the questionnaire yielded higher mean scores than items relating to Conservation, Knowledge and Welfare. Overall, the themes extracted closely relate to facets identified in previous quantitative research of attitudes to animals and conservation (e.g. Lukas and Ross, 2005), but differ to themes identified in qualitative research (e.g.) because of a dissimilar research focus, methods, context and sample. Therefore, indicating the complexity of conservation education in zoos.

4.1. Introduction

Two main educational aims of zoos and aquariums are to enhance public attitudes to animals and conservation (European Association of Zoos and Aquaria; EAZA, 2016). Zoos and aquariums are of special interest for student learning because they provide the opportunity to observe living animals in contexts often emulating their natural habitats and therefore strengthen students' connection to nature (Falk, 2014), as well as supporting classroom teaching (Wunschmann et al, 2017). In their mission statement, British and Irish Zoos and Aquariums (BIAZA) zoos list formal education as one of their priorities (EAZA, 2016), but there is limited evidence suggesting which aspect of zoo school field trips are most successful at enhancing attitudes to animals and conservation. Zoos aim to educate both informally (unstructured-education which occurs outside of the classroom) and formally (structured education), school visits usually consist of a half or full day, and some zoos also offer more intensive summer schools lasting up to a week (e.g. Blair Drummond Safari School, 2018; Retrieved from: https://www.blairdrummond.com/education)

Evaluations of school visits have primarily focused on formal learning outcomes, such as biological knowledge acquisition. For example, Miglietta et al (2008) assessed the impact of a structured school trip to a shark aquarium on knowledge retention of 537 students (9-18 years

old). Students' knowledge on six topics (anatomy of sharks, ethology, physiology, palaeontology, basking sharks, and plankton-filter feeding) were evaluated before the visit, immediately after the experience and three months after the visit, using a 33-item questionnaire (consisting of true and false statements and multiple-choice questions). Overall, scores were higher following the visit, for example students were most well informed about ethology, with percentage correct rising from 52% pre-visit to 87% on exiting the exhibit. Similarly, knowledge scores on palaeontology increased from 18% pre-visit to 75% afterwards. However, at a 3-month follow up, mean correct knowledge scores for all six topics decreased (entrance scores; males M = 13.02, females M = 12.10; exit scores males M = 23.84, females M = 25.37; follow up score males M = 19.20 and females M = 20.05) suggesting the impact of the school trip on knowledge retention was short-term, although some information had been retained at the follow up.

In a direct comparison of formal and informal learning outcomes in school children (N = 845, 10-12 years old) Randler et al (2012) assessed knowledge about vertebrates before and after a zoo visit. Although the same content was provided on signage in both conditions, those who engaged in a structured guided tour by a zoo educator scored more highly than those in the un-structured visit, therefore suggesting that the latter group did not engage with the interpretation available. This supports previous visitor dwell time research which found the average zoo visitor spends up to two minutes at each exhibit (Bitgood et al, 1988), and that the addition of an interactive element at a zoo exhibit can better engage visitors and enhance conservation learning (Swanagan, 2000; Perdue et al, 2012). Wunschmann et al (2017) compared knowledge retention in primary school pupils (aged 8-10 years, N = 65) after being taught about reptiles and amphibians either in the school classroom or at a reptile and amphibian zoo, where students could handle the animals. Knowledge retention was significantly higher for students that had attended the zoo, than those in the classroom teaching and a control group (who did not learn about reptiles and amphibians); the knowledge retention test showed a substantial effect size for the zoo group and a medium effect size for the classroom teaching group, when compared with the control group. This suggests that the zoo context and nature of activities were beneficial to short term and longer-term knowledge retention. While no data were collected on emotional responses, it is feasible that physical contact enhanced positive emotional responses therefore facilitating conservation learning; previous research indicates that positive emotional responses to zoo animals can facilitate learning (Myers et al, 2004). While boys performed better than girls in the classroom teaching group this gender difference

was not evident in either the reptile and amphibian zoo group and control group, suggesting that the zoo visit may have engaged girls better than the classroom alone. Similarly, Seybold et al (2014) used a questionnaire to compare knowledge retention in 1,013 school children between the ages 9-13 following learning about great apes (gorillas, chimpanzees and orangutans) while collecting observational data on their behaviour in a zoo, and those learning similar (theoretical) content within a standard classroom context. Students who visited the zoo scored significantly higher on the knowledge retention questionnaire, than those in the standard classroom context (although actual percentage scores are not fully reported), suggesting the zoo visit did have a positive impact on learning and supports previous research that interaction can enhance learning (Swanagan, 2000).

In a large-scale study, Dettmann-Easler and Pease (1999) investigated the impact of six different residential environmental education programmes, lasting from two days to five days (including classroom-based learning and interacting with nature), on 11-12-year-old students' attitudes towards conservation and wildlife. Pre-and-post questionnaires, and interviews were used to measure attitudes to wildlife in the experimental group (N = 697), and the same questionnaires were used to assess attitudes in the control group (N = 666) which participated in a classroom-based programmeonly. Results indicated that residential programme participants reported significantly more positive attitudes towards wildlife at the end of the programme than those in the control group, and this difference was maintained at the three-month follow up. However, the content of each residential programme differed for example, some focused on environmental education (particularly conservation and wildlife), while others were more orientated towards outdoor recreation activities (e.g. rock climbing and canoeing). Classroom-based programmes also focused on different topics, such as predators, prey, mammal skull identification and habitats. Overall, despite the differences between activities, participating in these residential programmes and interacting with nature for an intensive period, had a positive impact on conservation attitudes, which were sustained at least until the 3-month follow up. This supports previous research which found engaging with nature has many benefits (Kaplan and Kaplan, 1989) and could facilitate positive emotional responses which enhance conservation attitudes (Myers et al, 2004), and could explain why the residential programme had a more positive impact on attitudes than the classroom-based programme.

From the research reviewed here, it is apparent that school field trips to zoos can enhance knowledge, but retention is often short-term. More intensive programmes appear beneficial at

achieving a sustained learning outcome, although qualitative research examining the nature of these experiences are lacking. Using qualitative methods may allow for greater insight into the experiences and motivations of the students, as motivation has previously been shown to impact the learning process (Morgan and Hodgkinson, 1999; Ross and Gillespie, 2009).

While previous research suggests that school field trips can have a positive impact on cognitive learning i.e. recalling facts and concepts (Anderson and Lucas, 1997; Bamberger and Tal, 2007; Miglietta, Belmonte and Boero, 2008), there has been less consideration of the impact affective learning (feelings and emotions) can have on students' attitudes to animal welfare and conservation. To examine what 11-13-year-old students think they learned during a 'conservation week' at the zoo and how these experiences impacted classroom learning, Davidson et al (2010) used four sources of qualitative data (classroom and school trip observations, semi-structured interviews, written open-ended surveys), and a written assignment (associated with what they may have learned at the zoo). The interviews with each student were conducted after the trip (and three months later), and showed the children could talk about zoos, endangered animals and said the trip had a positive emotional impact on their learning. Three themes emerged from the analysis (using a constructivist grounded theory approach) of the four sources of data: social context (whether students were with friends), learning from the zoo trip was not strongly influenced by zoo educators, and learning was strongly influenced by their own teachers. For example, the children commented on the amount of time (20 minutes) the educator spent talking about the white rhinos, who were "standing around" grazing, whereas only five minutes was spent discussing the chimpanzees who came up to the viewing glass. After the trip, most students did not discuss anything they had heard about the white rhinos, but several talked about how important it was not to throw objects into the chimpanzee enclosure because they could catch human diseases. This supports previous research that active zoo animals could enhance learning (Hacker and Miller, 2016), and zoo visitor emotional responses to zoo animals could influence conservation learning (Myers et al, 2004; Powell and Bullock, 2014; Hayward and Rothenberg, 2004). Davidson, Passmore and Anderson (2010) also noted that the students reported learning more about the animal they were studying by talking with their friends, which resulted in greater knowledge of that species, indicating that the social aspects of contextualised learning may also be important. This study highlights the strength of qualitative methods in better understanding the experiences and outcomes of students engaged in learning activities at the zoo.

It is clear from the studies discussed above that structured school field trips have the potential to provide a good learning environment for students, and that engaging emotionally with zoo animals can enhance knowledge retention. However more research is needed to assess the impact educational programmes have on students' attitudes to animals and conservation. This present study aimed to examine the impact of an intensive five-day animal welfare and conservation education programme on teenagers' attitudes to animal welfare, conservation and emotion, using a short survey and analysis of focus group responses. 'Safari School' at Blair Drummond Safari Park, is open to fee-paying teenagers (age 14-17 years old) and targeted at those seeking further study or employment in zoos, veterinary studies or conservation. The purpose of evaluating the Safari School is to improve the understanding of the potential impact of such programmes on attitudes to conservation, welfare and emotion, and how participants perceive their experiences, which in turn could inform programme development and delivery. A focus group was conducted with one cohort on the programme and thematic analyses used to examine the experiences of students following completion of the programme. A better understanding of how young people engage in learning at the zoo is important for informing improvements in conservation education.

4.2. Methodology

Participants:The 11 safari school participants were all females (age; M = 15.55, SD = 1.03) attending the Safari School and were recruited on the initial morning of the programme (October 2017).

Ethics:On the morning of the first day of the Safari School, students were given an information sheet which included an explanation of the study aims. Both students and their guardians were aware that data would be collected by using a video camera to record the focus group. They were also aware that students would be identifiable only to the researcher, confidential data would be stored securely, and videos would be deleted once coded to NVIVO. Participation was voluntary, and it was stated on the sheet that guardians and/or students could withdraw consent at any time during the study, or for three months after, and their data would be deleted. To participate, both guardians and students were required to sign the consent form and hand back to the researcher (BPS, 2014).

Procedure: At the end of the one-week safari school study participants completed a 16-item questionnaire (the same one as previously used in Chapter 3, see Table 4.1), aimed at assessing their attitudes to conservation, welfare and emotion. A five-point Likert scale allowed participants to rate their agreement to each statement (Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, and Strongly Disagree). Items were all selected and adapted from questionnaires previously developed to examine attitudes to great apes and conservation (Paul, 2000; Lukas and Ross, 2005; Powell and Bullock, 2014). On the final day of the Safari School students took part in a 30-minute focus group discussion, guided by a set of structured questions (see Table 4.3). Following the focus group, participants were asked "please write up to 150 words to express your understanding and attitudes to the importance of conservation", these responses were included in the analysis of themes. At the end of the session, participants were also asked to indicate their personal preference for a hypothetical donation(of a non-specified value) to be made to World Wildlife Fund, the SSPCA or neither charity.

Table 4.1. *Questionnaire aimed at assessing emotion and students' attitudes to animals and conservation. Mean (and standard error) represents the average score for each item.*

Questionnaire Item	Mean Score (SE)
I take an interest in wildlife wherever I am.[1] (Emotion)	4.27(.141)
I have a good understanding of wildlife conservation issues.[1] (Knowledge)	3.27(2.37)
I am very interested in learning about the social lives of animals.[2] (Emotion)	4.36(.141)
I think a lot about the suffering of animals.[1] (Welfare)	4.00(.191)
I engage in pro-environmental efforts during my daily activities (recycling, reducing energy usage etc).[1] (Conservation)	3.90(1.07)
I feel that animals have a great influence on my mood.[3] (Emotion)	4.18(.182)
I always think about how my actions affect the environment[1] (Conservation)	3.64(.203)
I get very angry when I see animals being ill-treated.[3] (Emotion)	4.64(.203)
I think people often make too much of the feelings and sensitivities of animals.*[3] (Welfare)	3.45(.312)
I am confused about what is good and what is bad for the environment*[2] (Conservation)	3.55(.247)
I think zoos can play an important role in education and conservation[2] (Conservation)	3.73(.141)
I support the use of animals for experimental medical research that benefits humans*[2](Welfare)	3.73(.304)
I would prefer to watch a documentary about animals in the wild than see them in the zoo*[2](Emotion)	2.64(.244)
I do not think animals are entertaining to watch*[2] (Emotion)	3.09(.285)
I believe that some species are just meant to die out or become extinct*[2] (Conservation)	3.55(.312)

*Indicates reversed items from;[1] from Powell and Bullock, 2014; [2] from Lukas and Ross, 2005; from Paul, 2000.

Overview of the Programme Modules: Safari School students are taught five modules (Table 4.2). The theoretical sessions included lectures and discussions about each module from education and keeper staff. For examples, students were taught the importance of enrichment and how welfare can be enhanced by allowing captive animals to engage in species appropriate behaviours, e.g. wild giraffes eat from trees, so students were given browse to hang on a post for their captive counterparts. Another session consisted of explaining how the sea lions are trained using positive reinforcement methods and how this reduces stress during veterinary checks, and students were given the opportunity to watch this training.

Table 4.2*. Description of each Safari School module the students would have been taught about.*

Modules
Introduction to Animals – insight into the classification of taxonomic groups. **Animal Enrichment** – how animal welfare is enhanced by providing stimulating apparatus/enclosures. **Animal Health** – introduction to veterinary care of zoological animals. **Animal Husbandry** – how zoological animals are cared for daily. **Enclosure Design** – how enclosures are designed to suit the biological and behavioural needs of animals. **Animal Behaviour and Training** – the concept of animal behaviour, how humans perceive this, how to replicate natural behaviours and how to use training for veterinary checks. **Animal Conservation** – an introduction to the threats that face wild and native animals and actions that students can take to protect them. **Nutrition** – an insight into the main food groups and what they do for the body. How animals are fed based on their biological needs and natural feeding regimes.

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Table 4.3. *Structured schedule of open-ended questions asked during the focus group.*

Open-ended Questions
1. What did you expect to learn?
2. What was most beneficial to you?
3. What are the benefits of human-animal interactions?
4. What are the risks of humans interacting with animals?
5. How do humans negatively impact species and their environments?
6. Can you identify future actions you could engage in to support conservation?
7. Why is conserving species important?
8. Should animals be treated with the same respect as humans?

4.2.1. Data Analysis

Group audio recorded interviews and written answers to semi-structured questions were transcribed and analysed in NVIVO 10 (QRS International, Melbourne, Australia). All transcriptions were coded by question before themes were identified. Themes were identified from the literature and provided a prior codes for coding; previous studies have identified factors which may have a positive impact on zoo visitors' understanding of Conservation and Welfare (Dettmann-Easler and Pease, 1999; Hayward and Rothenberg, 2004), and how Emotion (Powell and Bullock, 2004;Myers et al, 2004) and Knowledge (Lukas and Ross, 2009; Seybold et al, 2014) can influence conservation learning. Thematic analysis was used to identify and analyse patterns in the data, themes were reviewed and revised as analysis progressed (Braun and Clarke, 2006). Themes were not mutually exclusive and responses could be assigned to multiple themes.

4.3. Results

Questionnaire scores (see Table 4.1) were all very positive, and this was expected given the high motivation of students attending the programme. The questionnaire is described as assessing attitudes to Conservation (overall mean for Conservation items: M = 3.61, SD = .10), Emotion (M = 4.27, SD = .09) and Welfare (M = 3.72, SD = .27). One item from Lukas and Ross's questionnaire 'I would prefer to watch a documentary about animals in the wild than see them in the zoo' yielded the lowest mean score, therefore participants would rather go to the zoo to see animals than watch a documentary. A Friedman test was used to establish if there were any statistically significant differences between mean scores on the three components (Conservation, Emotion, Welfare), $X2(2) = 4.667$, $p = .097$ but no significant differences were found.

All participants chose to hypothetically donate to a charity, with almost all (10/11) choosing WWF (Conservation) and only one choosing the SSPCA (welfare).

Table 4.4. *Frequency of themes (Conservation, Emotion, Knowledge and Welfare) mentioned by each participant (N=11).*

	Conservation		**Emotion**		**Knowledge**		**Welfare**		
Participant	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	**Total**
1	3	37.5	0	0.0	0	0.0	5	62.5	8
2	3	42.9	0	0.0	2	28.6	2	28.6	7
3	3	42.9	1	14.3	1	14.3	2	28.6	7
4	4	50.0	0	0.0	2	25.0	2	25.0	8
5	5	62.5	0	0.0	2	25.0	1	12.5	8
6	4	50.0	0	0.0	1	12.5	3	37.5	8
7	4	44.4	0	0.0	2	22.2	3	33.3	9
8	4	50.0	0	0.0	2	25.0	2	25.0	8
9	4	50.0	0	0.0	1	12.5	3	37.5	8
10	4	50.0	0	0.0	2	25.0	2	25.0	8
11	6	66.7	1	11.1	0	0.0	2	22.2	9
Mean	**4**	**49.71**	**0.18**	**2.31**	**1.36**	**17.28**	**2.45**	**30.70**	**8**

Table 4.5. *Frequency of themes (Conservation, Emotion, Knowledge and Welfare) discussed by students for each open-ended question (see Table 4.3 for open-ended questions).*

	Conservation		**Emotion**		**Knowledge**		**Welfare**		
QUESTIONS	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	*Count*	*Percentage*	**Total**
1	0	0	0	0	10	62.5	6	37.5	16
2	2	11.8	2	11.8	7	41.2	6	35.3	17
3	1	5.9	2	11.8	5	29.4	9	52.9	17
4	2	16.7	0	0	0	0	10	83.3	12
5	10	76.9	0	0	0	0	3	23.1	13
6	6	60	0	0	2	20	2	20	10
7	11	64.7	0	0	1	5.9	5	29.4	17
8	2	28.6	2	28.6	0	0	3	42.9	7
9	11	40.7	2	7.4	6	22.2	8	29.6	27
MEAN	4.5	30.53	0.8	5.96	3.1	18.12	5.2	35.4	
TOTAL	45		8		31		52		136

Conservation:

The most prevalent theme was Conservation, which accounted for 50% of all content coded. Conservation included understanding of species conservation and conservation behaviours.

Why is conserving species important?

"*Conservation is good, it helps to keep animals from extinction it's like protection. In the wild they get poached*". Participant 5; focus group.

Conservation self-efficacy was good, participants understood activities they could engage in to help the environment and support in-situ and ex-situ conservation programmes.

Can you identify future actions you could engage in to support conservation?

"*Work to stop deforestation of habitat. Make sure there is no litter*". Participant 4; written statement.

In their written responses on their understanding and attitudes to the importance of conservation (up to 150 words), participants often included multiple themes and demonstrated a high level of understanding of conservation issues, for example:

"I feel that conservation is vital in maintaining the next generation of certain species. Without conservation certain species may go extinct and impact the whole ecosystem in areas (understanding of biodiversity). *To support conservation we can recycle, donate to charities and educate those who may be ignorant towards the plight of certain species and education (especially at a young age) can shape their viewpoints and impact the outlook the next generation have on conservation"* (understanding of conservation self-efficacy*)*. Participant 8; written statement.

Emotion:

Emotion is included as a theme although only two participants identified the importance of emotion and their personal encounters with the animals. Both stated these encounters were beneficial, suggesting that they experienced positive emotions in this context:

What was most beneficial to you?

"Being able to meet the animals and come into close contact with them". Participant 11; written statement.

"*The close-up experiences with the animals like the tiger, chimpanzees, rhino, elephant, lemurs etc and seeing them during training"*. Participant 3; written statement.

In their written responses on their understanding and attitudes to the importance of conservation (up to 150 words), participants included multiple themes, including identifying emotion and aesthetics as providing underlying motivation for supporting conservation for example:

"*I think conservation is extremely important because animals are amazing and beautiful (emotional affiliation to animals), so we should save them because otherwise our planet would be bleak and lifeless (understanding of biodiversity and aesthetic value of nature). We need to conserve them so that our planet can continue to thrive and evolve (understanding of biodiversity), rather than humans destroying all other life (understanding of anthropogenic activity)*". Participant 11; written statement.

Knowledge:

The theme of knowledge (or learning) accounted for 17% of all content and most participants (9/11) identified their motivation to learn about animal husbandry and the role of zoo keepers.

What did you expect to learn?

"*About animals and what zookeepers do".* Participant 2; focus group.

"I expected to learn about what goes on behind the scenes and about how they take care of the animals". Participant 6; written statement.

The two previous examples indicate a relatively good knowledge of the complexity of conservation.

Welfare:

All participants discussed Welfare and this theme accounted for 31% of all content coded. Participants particularly focused on the benefits of animal training, as many stated it would improve the emotional wellbeing of the animal. Some discussed the importance of training the animals to accept veterinary care. Participants had a good understanding of how human-animal interactions can negatively impact animal welfare and behaviour, and reintroduction programmes.

What are the benefits of human-animal interactions?

"Benefits animals by enriching their lives through training". Participant 8; focus group.

What are the risks of humans interacting with animals?

"Animals becoming over-dependent on humans and losing their natural instincts and skills. Humans are often in a position where they have power to abuse or mistreat animals". Participant 11; written statement.

In their written responses on their understanding and attitudes to the importance of conservation (up to 150 words), participants often included multiple themes and demonstrated an understanding of the impact of human-animal interactions, a high level of understanding of related conservation issues, and the importance of animal welfare, for example:

"I feel as long as the enclosures are safe and comfortable for the animals (welfare)*, I feel conservation is good for animals as it allows us to understand them better* (ex-situ conservation)*. Ways to support conservation are by donating to charities, learning about animals or visiting safaris"* (conservation self-efficacy). Participant 1.

4.4. Discussion

Thematic analysis identified four themes; Conservation, Emotion, Knowledge and Welfare. Conservation was the most prominent theme, though this was to be expected as the structured focus group questions and written answers were aimed at assessing understanding and attitudes to conservation. Overall, participants had a good understanding of conservation and this theme featured prominently, for example, Question 5 of the focus group ("How do humans negatively impact species and their environments?") produced the most responses to Conservation (76.9%). However, Conservation had the lowest mean score (M = 3.61) for the quantitative data – although still reasonably high, it does not triangulate with the qualitative data.

It was expected the theme of Emotion (associated with Humanistic attitudes; interest and affection for individual animals) would be more predominant as previous research indicated zoo visitors react more emotionally to animals (Myers et al, 2004), although there were no focus group questions directly related to emotion. Participants did score highly on items relating to emotional responses to animals on the questionnaire (M = 4.27) and it is not clear why this aspect was not more evident in the qualitative responses. Knowledge was featured across all responses, and apart from Participants 1 and 11, Question 1,"What did you expect to learn?" elicited the most Knowledge responses (62.5%), and supports previous research which suggested that a zoo field trip can have a positive impact on cognitive learning (Anderson and Lucas, 1997; Bamberger and Tal, 2006; Miglietta et al, 2008). Only one item on the quantitative data was associated with Knowledge, but participants' written answers regarding their understanding and attitudes to conservation allowed a more in-depth demonstration of their knowledge. However, the present study did not directly assess previous knowledge (prior to programme participation), so causality cannot be determined, especially as these were a motivated group participating in a specialist programme and may already have had a good understanding of animals, welfare or conservation.

It was difficult to encourage participants to discuss the open-ended questions during the focus group, although they had spent the last five days getting to know each other, the group were generally quiet. Using both a focus group and written component is important as it allows for each member to contribute, and the written statements were more effective at gathering information on participants' understanding and attitudes towards conservation. Similar written statements on other topics would have been useful and allow a deeper insight into participants'

understanding and attitudes. Rather than reflecting on their own experiences gained from the Safari School, participants tended to focus on knowledge acquired during their experience and could be because the focus group questions were positively loaded and leading. The predominant theme from the focus group, Conservation, is associated with Naturalistic attitudes in Chapters 2 and 3, therefore participants were interested in and had affection for animals and their habitats. Overall, participants were very positive about their experiences on the programme and attitudes to conservation. Themes for Conservation and Welfare featured prominently across all participant responses, with only two participants (3 and 11) giving answers related to the theme of Emotion. Question 4 ("What are the risks of humans interacting with animals?") was most associated with Welfare responses (83.3%). Students were able to describe the importance of conservation and future actions they could engage in to support both in-situ and ex-situ conservation programmes, which is congruent with what they had been taught in the conservation module. Davidson, Passmore and Anderson (2010) highlighted the importance of using qualitative methods to better understand young people's study highlights the strength of qualitative methods in better understanding the experiences and outcomes of students engaged in learning activities at the zoo. The present study demonstrates the benefits of using both qualitative and quantitative methods, with the written statements producing the most in-depth responses and suggesting participants had a good understanding and positive attitudes towards conservation.

All participants attending the Safari School were female, this is not surprising given that a high percentage (77%) of applicants to veterinary school are female (Perrin, 2016). Given participants' high motivation for attending the Safari School, it was expected students would respond more emotionally to the programme as previous research indicates females respond emotionally to animals (Kellert, 1984) and this can have a positive impact on conservation learning (Myers et al, 2004). Participants often indicated their motivation for signing up to the Safari School was to learn about animal husbandry and the role of zoo keepers, and this is evident in their identification of vocational learning as being beneficial during the focus group. As motivation has previously been shown to impact the learning process (Morgan and Hodgkinson, 1999; Ross and Gillespie, 2009) it would have been useful to collect pre and post data using the questionnaire and explored their understanding of conservation and motivation to attend the safari school. 10 out of 11 participants chose to hypothetically donate to WWF, which is a well-known conservation charity and mostly focuses on efforts to save exotic animals. It was expected that given participants motivation for signing up to the Safari School,

a large proportion of the participants would choose WWF over the SSPCA. Given the results, this is a good indicator that the zoo experience had a positive impact on participants' understanding of species conservation (as per the core focus of activities and programme).

In general, the themes extracted from this study are congruent to dimensions identified in previous quantitative studies of attitudes to animals and conservation (e.g. Lukas and Ross, 2005) and consistent with findings in Chapters 2 and 3. The written statements generated the most in-depth responses and suggested participants had a good understanding and positive attitudes towards conservation, but the differences in results collected using both quantitative and qualitative methods are suggestive of the complex nature of conservation education in zoos.

5. Discussion

Review of Thesis Aims

While zoos and their visitors identify education as a high priority, it remains unclear whether zoos meet their stated conservation education goals due to a lack of research to examine efficacy and impact. The literature review indicated that several factors shape visitor experiences and learning outcomes, including participant characteristics and exhibit characteristics, and that engaging visitors in learning may be a challenge due to other motivations for visiting a zoo. The first two studies examined whether attitudes to animals and conservation could be influenced by the emotional salience of the visitor experience at an exhibit (Chapter 2) and by the type of information provided in interpretation materials (Chapter 3). Chapter 4 used a focus group methodology to explore the experiences of young people attending a conservation and welfare programme in a zoo context, to provide a richer insight into how experiences may shape attitudes and behaviours.

This final chapter summarises and discusses the main findings from previous chapters (see Table 5.1 for a summary and interpretation of results),in terms of how these relate to each other and the literature. For example, enhancing emotional connection and focusing on social behaviour of animals may help promote effective conservation education. However, effects were small, and it is important to understand variation in visitor and exhibit characteristics in order to refine zoo conservation education.Strengths and limitations of this work are discussed and aims for future research suggested. Lastly, as the ultimate goal of this research is to help enhance the promotion and efficacy of conservation education in the zoo, a set of practical recommendations (see Table 5.2) for those working in zoo education are provided. These recommendations primarily relate to the potential of collaborative research to evaluate the evidence base, enhance research design and refine measures that are required to meet their requirements to monitor the impact of conservation education.

Four key aims were identified:

1. To examine the impact of enhancing an emotional connection to animals in facilitating positive attitudes towards animals and conservation (Chapter 2).

2. To examine whether the type of information presented as interpretation influences people's attitudes to animals and conservation (Chapter 3).

3. To explore the experiences of young people participating in an intensive programme, to provide insight into factors shaping learning of attitudes towards animals and conservation (Chapter 4)

4. To consider the practical implications of the research findings for conservation education in a zoo context and develop a set of recommendations for enhancing practice (Table 5.2).

Table 5.1. *Summary and interpretation of results from Chapters 2, 3 and 4.*

Study	Summary of Results	Interpretation
Study 1: Engaging Zoo Visitors at Chimpanzee Exhibits Promotes Positive Attitudes Towards Chimpanzees and Conservation. N = 197(BTEZ) N = 302 (BDSP) N = 216 (Online) Measures: Questionnaire (attitudes to chimpanzees and conservation, N = 12 items) Donation task (BTEZ only)	**Attitudes to Chimpanzees and Conservation.** **Questionnaire** At Blair Drummond Safari Park (BDSP), Naturalistic and Humanistic attitudes were higher after Emotion Enhancement Task (EET) than in the control condition. Humanistic attitudes were higher following EET than control and Online. At Budongo Trail at Edinburgh Zoo (BTEZ), Naturalistic and Humanistic attitudes did not differ between conditions, but were higher than the online control condition. **Behavioural measure** No difference between conditions for donation choice. Stronger Naturalistic attitudes were associated with the likelihood of donating to native species (Scottish wildcat campaign). **Participant characteristics** Pet owners scored more highly on both Naturalistic and Humanistic attitudes. Zoo members scored more highly on Naturalistic attitudes. High Agreeableness was associated with lower score on Naturalistic and Humanistic attitudes, while higher Neuroticism was associated with stronger Humanistic attitudes.	Attitudes differed according to both visitor characteristics (including pet-owing, zoo membership, and personality) and context (zoo facility). At BTEZ, interactive tasks had no more impact that the standard interpretation available at the exhibit, but at BDSP the enhanced interpretation was beneficial. Emotional enhancement has the potential to promote positive conservation attitudes but differences between all conditions were small in magnitude. Conservation attitudes were associated with stable participant characteristics and therefore likely to prove difficult to change, at least with brief interventions. Donation choice measures may be effective (as both low cost, easy to implement) in assessing zoo visitor attitudes in relation to conservation initiatives (i.e. Scottish wildcat, BTEZ). Limitations: This was a brief intervention which aimed to enhance emotional connection to animals; there was no condition that directly aimed to change beliefs and attitudes to conservation. The Interactive Control condition was only implemented at a single site. Pre-visit (and follow-up) data was not collected to assess within participant changes in attitudes or donation behaviour, and the latter measure was only collected for a subsample.
Study 2: Impact of Interpretation Content on Attitudes to Great	**Content ratings** Physical content was rated as being most relevant in a zoo context, but Social content was rated as the most engaging.	Social content was rated as most engaging and this preference was validated by higher reading duration. Type of content had no impact on Humanistic and Utilitarian attitudes; social framing may be effective in enhancing Naturalistic attitudes, but this trend should be

Table 5.1. *Summary and interpretation of results from Chapters 2, 3 and 4.*

Study	Summary of Results	Interpretation
Ape Conservation and Welfare N= 184 Questionnaire Charity visit Time spent reading	**Attitudes to Great Ape Conservation and Welfare** No differences between conditions for Humanistic and Utilitarian attitudes, and a non-significant trend for Naturalistic attitudes to be higher in the Social condition. **Zoo incidentitem ratings** There were no differences in ratings between the positive and negative incident condition (except recall of more recent). Stronger Naturalistic attitudes were associated with higher scores on items relating to concern about great ape welfare and the importance of conservation. Stronger Humanistic attitudes were associated with concern for welfare. Stronger Utilitarian attitudes were associated with the perception that great apes were entertaining to watch. **Behavioural measures** Reading duration was significantly higher in the Social condition. Mean ratings of content, mean reading time, and strength of Naturalistic, Humanistic and Utilitarian attitudes did not differ between those who did and did not choose to visit relevant website. **Participant characteristics** Female participants scored higher on Naturalistic attitudes than males.	investigated within a zoo context. Physical content was rated most relevant, perhaps due to similarity to standard zoo signage. Females scored higher on Humanistic attitudes only, reflecting higher levels of affection towards animals. Attitudes to great apes were not influenced by exposure to a positive or emotion zoo incident, but scores did map onto strength of Naturalistic, Humanistic and Utilitarian attitudes, indicating measures were reliable. Condition and attitude measures did not predict whether a participant was more likely to visit a relevant website at the end of the study. **Limitations** This was a brief online intervention (viewing a few slides and short case study) and there was no clear impact on attitudes or donation behaviour. Lacked pre-and-post measures (and follow-up) of attitudinal change, and recency or frequency of zoo visits were not recorded. Human error in data collection reduced the sample size available for some measures. The Zoo incident manipulation was ineffective but watching videos of such incidents may be more emotive. Motivation to visit a relevant website was not collected for all participants, and there was no measure of duration spent viewing the website.
Study 3: Evaluating the Impact of an Animal Welfare and Conservation Education	Four themes were identified from focus group discussions (in order of prevalence): Conservation, Welfare, Knowledge, and Emotion. Emotion (Humanistic; affection for animals) was the least prominent theme, but related items were scored highly on the questionnaire.	Overall, participants were highly motivated to engage in the programme and related this to their career aspirations. All were positive about their experiences on the programme, but few identified emotional responses to animals as an important feature. Participants showed a good understanding of conservation and this was reflected in the focus group (thematic analysis), and particularly in the written

Table 5.1. *Summary and interpretation of results from Chapters 2, 3 and 4.*

Study	Summary of Results	Interpretation
Programme on Teenagers' Attitudes to Animals and Conservation. N = 11. Short Questionnaire, focus group and written statement.	10/11 chose hypothetical donation to conservation charity (WWF) rather than welfare charity (SSPCA).	statements which often highlighted the complexity of conservation. **Limitations** Pre and post programme measures are desirable as participants are likely to have shown strong positive attitudes towards animals and conservation prior to the programme. A suitable control group was lacking, a waiting list control group might be most appropriate, given high motivation of those attending such programmes. Individual interviews or additional short written answers may be more appropriate for the social dynamics of the sample, as the focus group was brief and participants were quiet. There was limited personal reflection and participants seemed to perceive questions in terms of demonstrating knowledge gained during the programme.

BDSP refers to Blair Drummond Safari Park. BTEZ refers to Budongo Trail at Edinburgh Zoo.

5.1.1.

5.1.2. Summary of Aim 1

Aim 1: To examine the impact of enhancing an emotional connection to animals in facilitating positive attitudes towards animals and conservation

Previous research suggests that visitors' emotional responses and sense of connection to animals can positively influence conservation learning(Dierking et al, 2002; Falk and Gillespie, 2009; Myers and Saunders, 2002; Myers et al, 2004; Vining 2003; and Smith et al, 2008). Although a sense of emotional connection to zoo animals has been suggested as promoting learning and care for conservation at an exhibit (Abell et al, 2013), there were no studies which had aimed to manipulate this factor to examine the impact on zoo visitors' attitudes to conservation. A between-subjects design was chosen with a standard visit condition, an interactive (non-emotional) task, and an online condition were used to try to disentangle emotional connection from other aspects of the experience, namely visiting the zoo and watching the chimpanzees, exposure to the standard interpretation at the chimpanzee exhibits, and participation in an interactive task at the zoo. For example, the Location task at BTEZ was introduced as there was concern visitors may have been engaging with the researcher whilst partaking in the Emotion Enhancement task, not the chimpanzees, and this may have unintentionally biased the results. Overall, the results of Study 1 suggest that having a more emotionally engaging experience with an animal can enhance attitudes to conservation. Nonetheless, all differences between conditions were small in magnitude, even compared to the online condition, although online participants were recruited for a survey on chimpanzee conservation and their positive attitudes could be explained by their predisposed interest in the topic. Moreover,the impact of the emotion enhancement task was not consistent between visitors at two chimpanzee exhibits, which differed in their exhibit design and interpretation provided. For example, at BTEZ the emotion enhancement and interactive conditions, but not the Control condition, led to higher mean scores than the Online condition. These findings highlight an important issue in conducting zoo research; studies conducted at a single location may not be generalisable to other contexts. Several studies have compared two or more exhibits housing different species within the same zoo (e.g. Foote et al, 2012; Lukas and Ross, 2015), but it is not always clear which other characteristics differ between exhibits. More studies that examine the same species across multiple sites are desirable because this allows research findings to be contextualised. This approach would further enhance our understanding of those factors shaping the visitor experience and identify those core components that could be implemented more widely to enhance conservation learning at other zoos.

The behavioural measure of hypothetical donation was added to validate the questionnaire at BTEZ. The results suggested that those with positive Naturalistic attitudes opted to donate to Scottish wildcat conservation, rather than chimpanzee conservation, while very few participants chose neither charity. This suggests that some BTEZ visitors have an interest and affection for nature and wild animals e.g. Scottish Wildcat, and that interpretation aimed at educating visitors about the plight of Scottish wildcats was successful, perhaps due to the impact of local identity as a factor in promoting conservation (Clayton and Myers, 2009). The success of the campaign could also explain why this finding was incongruent with previous research suggesting people prefer conserving (and donating to) animals that are most similar to humans.(Colleonyet al, 2017; Gunnthorsdottir, 2001, Plous, 1993). The behavioural measure of donation was also compared across conditions, but this yielded no significant results, possibly because of the impact of the Scottish wildcat conservation initiative.Behavioural measures could be used as a low-cost, easy to implement, way to assess the impact of conservation initiatives,(e.g. Dotzour et al,2002; Swanagan, 2000) but need to be refined and validated against other measures to prove their efficacy. Overall, it is evident that emotional enhancement can be effective in promoting positive conservation attitudes, but both visitor characteristics (e. g pet owning, personality) and contextual factors (exhibit design and interpretation) also impact attitudes reported.

5.1.3. Summary of Aim 2

Aim 2: To examine whether the type of information presented as interpretation influences people's attitudes to animals and conservation.

Informative signage about the display animals' biological characteristics and their natural habitat is the most common and cost-effective way for zoos to adhere to EAZAs' educational standards (EAZA, 2008; 2016). Engaging and interesting interpretation with clear and concise messages, placed in strategic locations, is vital for encouraging visitors to read them (e.g. Roe, 2015). Previous research suggested that humans were more likely to attend to, and recall with greater accuracy, socially engaging information rather than physical information (Dunbar, 1998; Mesoudi et al, 2006). Therefore, study 2 investigated the impact of how species interpretation is presented on attitudes to great ape conservation by manipulating the type of information presented in interpretation contents. The results suggested significant differences for mean ratings of how relevant and engaging participants thought the slides would be if used

in a zoo. Participants in the Physical condition reported the slide as most relevant, whereas those in the Social condition rated the slide most engaging and this was validated by an increase in reading time, compared with those in the Physical and Husbandry conditions. Therefore, the content of interpretation impacts both visitor perceptions of relevance and engagement. Participants considered Physical information more relevant than either Social or Husbandry and this could be because of their perceived similarity to their expectations of standard zoo signage, although data was not collected on whether participants had recently or frequently visited a zoo to test this hypothesis.

These results not only support previous research (e.g. Dunbar, 1998; Mesoudi et al, 2006), but also have important implications for zoo interpretation. All animals interact socially, over territory or mating, therefore interpretation should focus on informing visitors of these social interactions as well as information regarding their conservation. Interactive exhibits have been shown to enhance visitor attitudes to conservation (e.g. Dotzour et al, 2002; Perdue et al, 2012; Swanagan, 2000), but there has been less consideration of the impact interactive interpretation may have on conservation attitudes. Many zoos display live videos of their animals giving birth on websites, the impact of this on attitudes should be investigated. The introduction of supplementary short videos (e.g. of social play or aggression) could be monitored using a brief questionnaire aimed at assessing attitudes to conservation, and behavioural measures (donation, petition signing; Swanagan, 2000). The results also found a marginally non-significant difference between Naturalistic (interest and affection for wildlife and nature) scores according to condition, with those in the Social condition having more positive Naturalistic attitudes than those in the Physical and Husbandry conditions. No significant differences for Humanistic and Utilitarian scores according to condition were found. Therefore suggesting, that focusing on Social information can enhance Naturalistic attitudes, but Humanistic and Utilitarian attitudes may be more difficult to change. The Naturalistic component was reflected in post-zoo incident question scores where a positive correlation between Naturalistic attitudes and concern about the welfare of great apes in captivity and agreement with conserving wild great apes was found. Differences were only found with Humanistic attitudes and gender, with females having more positive attitudes than males therefore supporting previous research (Myers et al, 2004; Powell and Bullock, 2014). The findings of this study illustrate that although self-reported attitudes were not influenced by condition (Social, Physical or Husbandry), ratings of engagement and time spent reading interpretation varies according to the type of information provided, which may have important implications regarding interpretation in the zoo context.

5.1.4. Summary of Aim 3

Aim 3: To explore the experiences of young people participating in an intensive programme, to provide insight into factors shaping learning of attitudes towards animals and conservation.

Study 3 aimed to better understand how young people engage with learning opportunities at the zoo. A cohort of students participating in a week-long Safari School Programme participated in a focus group, completed a short questionnaire investigating emotion and students' attitudes to animal conservation and welfare. Thematic analysis indicated four themes, Conservation, Welfare, Knowledge and Emotion. The themes showed that the dominant attitude was Conservation, which refers to an interest and affection for wildlife and habitats, and supports findings in Chapters 2 and 3, that my participants (some of whom were zoo visitors) have an interest in conservation. Interestingly, the least prominent theme was Emotion, which is related to Humanistic attitudes (affection for animals). This incongruence with findings on the role of emotion in previous Chapters could be explained by students not fully understanding the aim of the focus group; they appeared to primarily focus on demonstrating knowledge gained during their time at the Safari School rather than reflecting on their own personal experiences. Although not statistically significant, the statements relating to Emotion on the questionnaire generated the highest mean score, when compared to statements relating to Conservation, Knowledge and Welfare, therefore supports Myers et al (2004) that zoo visitors respond emotionally to zoo animals.

There are some constraints on the interpretation of the themes related to the methodology used. The participants were generally very quiet during the focus group and throughout the Safari School, individual interviews may have yielded more information, although time constraints meant this was not feasible. Previous research from Davidson et al (2010) suggested that social interactions are important factors in enhancing conservation learning, perhaps more emphasis should be placed on team building exercises at the start of zoo educational programmes. The written statements produced the most in-depth responses and suggested that participants had a good understanding and positive attitudes to conservation. However, as I was unable to successfully recruit a control group, it is not clear whether participants had a good understanding and positive attitudes towards conservation before starting the Safari School. Pre-programme measures or a waiting list control condition, would have allowed a clearer understanding of whether attitudes changed because of programme participation. Follow-up interviews or questionnaires would have been useful to examine whether attitudes and

knowledge to conservation were retained longer-term, although given that participants had willingly signed up to the Safari School it is expected that positive attitudes and knowledge acquisition would be long-lasting(Dettmann-Easler and Pease, 1999). In general, the themes extracted from this study are congruent to dimensions identified in previous quantitative studies of attitudes to animals and conservation(e.g. Lukas and Ross, 2005), and indicate the complexity of conservation education in zoos. Overall, the themes extracted closely relate to facets identified in previous quantitative studies of attitudes to animals and conservation (e.g. Lukas and Ross, 2005) and indicate the complexity of conservation education in zoos.

Overall, the findings of this thesis indicate that an emotionally engaging animal experience and information does enhance visitor attitudes to conservation. These results are consistent with research discussed in Chapter 1 which suggested an emotionally engaging experience can enhance attitudes to conservation, however factors such as exhibit design and interpretation are also important (e.g. Myers et al, 2004; Powell and Bullock, 2014). Visitor characteristics (gender and personality) impact their engagement with conservation education and is in line with previous research discussed in Chapter 1 (Milfont and Sibley, 2012; Myers et al, 2004, Powell and Bullock, 2014), therefore designing educational strategies that accommodate the variation in visitor characteristics will enhance conservation education as well as the visitor experience. Focusing on individual animal information (personality, social behaviour) is a simplistic and low-cost way to improve visitor engagement and enhance conservation attitudes, but the effectiveness of this strategy needs to be more fully evaluated.

5.2. Limitations and Future Directions

Enhancing conservation education within zoos is challenging, and many factors need to be considered (visitor characteristics, exhibit design, interpretation). One important component appears to be the emotional connection between animal and zoo visitor. The results from Chapters 2, 3 and 4, provide some support to previous research that people respond emotionally to animals and this can enhance conservation learning (Myers et al, 2004), although this was not found at BTEZ and illustrates how factors (variability in visitors and interpretation) can influence the success of conservation education. One key limitation of the research within this thesis, is a lack of pre-and-post and follow-up measures of attitudinal change. In Chapter 2, a within subjects' design was used because in zoos, it may not be feasible to design a study that consists of pre-and-post measures as there is the expectation visitor enjoyment will be negatively impacted. To meet their aim of monitoring conservation

education efforts, zoos could provide more support to researchers, perhaps offering visitors free-entry in return for participation would lessen the negative impact of collecting both in pre-and-post measures. Using a shorter scale and behavioural measures to investigate visitor attitudes to conservation would have less impact on visitor enjoyment. My results and those of previous studies (e.g. Myers et al, 2004) do suggest that zoo visitors respond emotionally to animals, therefore future research should ensure that scale items also measure emotional responses (as in Chapter 3). Additionally, if Chapter 3 displayed videos of social behaviour, instead of static images, it may have had a greater impact on the attitudes of participants. While collecting data for Chapter 2, differences in interpretation at both BTEZ and BDSP were noted. BTEZ had more immersive interpretation, such as touch tables, individual life histories, information (including a skeleton) depicting the similarity of chimpanzees to humans. Previous research has found that a more immersive zoo experience enhances conservation attitudes (Dotzour et al, 2002; Perdue et al, 2012; Swanagan, 2000), this could explain why my results suggested that the standard interpretation at BTEZ had a positive impact on conservation attitudes. The hypothetical donation data was only collected at one site, BTEZ, so it is not known what this behavioural measure would have shown if it were used at BDSP and whether it would provide support to previous studies where participants have a preference for donating to charismatic species and those that are deemed more similar to themselves (Colleony et al, 2017; Gunnthordottir, 2001; Tisdell et al, 2007). Those who had positive Naturalistic attitudes were more likely to donate to Scottish wildcat conservation. Future research should investigate how attitude type or sense of identity with the location of a species impacts on donation choice.

This thesis has been instrumental in identifying the importance that an engaging emotional experience with an animal can have on zoo attitudes to conservation, it is particularly vital where there is a lack of immersive interpretation within exhibits. A greater emphasis to facilitate an emotionally engaging experience at the zoo should be adopted by zoo educators. Considering the diversity of visitors (e.g. gender and personality), different types of interpretation should be made available. For example, zoos could incorporate technology into their zoo education, using mobile apps will allow visitors to select topics they are interested in, therefore accommodating variation in preferences (Moussouri and Roussos, 2013). Less emphasis should be placed on the reliance of self-reported attitude changes, technology could be used to assess behavioural measures; zoo visitors could follow a link to a conservation charity petition, or those with more Utilitarian attitudes could read further information about becoming a zoo member or volunteering at the zoo. Displaying videos of social interactions

(on the mobile app) may also be beneficial if the animals are not always visible to the public or often inactive, as well as aiding education. However, there are difficulties in enhancing approaches to zoo conservation education, for example, an awareness of the methodological challenges that impede zoo research is necessary. Table 5.1 summarises the complexities and challenges, identified in Chapter 1, of enhancing conservation education in a zoo context, the practical implications of the research findings from Chapters 2, 3 and 4, are acknowledged and based on these, a set of recommendations for enhancing practice.

Table 5.2. *Recommendations for enhancing conservation education in a zoo context.*

Issue	Challenges	Recommendation
Motivation of zoo visitors: entertainment not education.	Visitors often have minimal engagement with interpretation (e.g. time spent reading signage and dwell times). Context is important; skilled presenters and active animals have been shown to increase visitor receptivity to learning, whereas unskilled presenters can have a negative effect (Falk, 2006; Perdue et al, 2012).	Zoo visitors consider education a priority (e.g. Roe, 2015) but learning needs to be engaging and balanced with other aspects of the experience (enjoyment of watching animals). The activity of a species and locations for activities should be considered. Staff and volunteers involved in educational activities should be provided with adequate training.
Motivation to read interpretation signage	Often low visitor engagement, due to perceived familiarity, interest and amount of material (Roe and McConney, 2014). Low consensus from visitor on desirability of different types of information (Fraser et al. 2009). Visitor perceptions of labels used may be negative (e.g. Carson, 2012).	Focus on conveying fewer key messages, additional detailed information could be provided via supporting web resources or interactive hubs. Visibly categorise information types (biological, behavioural, conservation status) to allow visitors to identify topics of interest. Highlighting social information may help engage visitors (Chapter 3 – found social more interesting but felt physical equally informative). Careful consideration of how activities are labelled and presented is required, to avoid terminology which may be perceived negatively by visitors.
Diversity of target audience	Variability in visitor characteristics which may impact on learning.	Design educational strategies that accommodate the variation in visitor personality traits and gender. Provide variety of learning activities to broaden appeal to wider range of visitors.
Measuring changes in attitudes	Zoo visitors generally more concerned about conservation than other members of the public (e.g. Adelman et al, 2003) which introduces a sampling bias.	Identifying a suitable control group can be difficult. Repeated measures (pre and post visit) or comparing groups of zoo visitors in different conditions (interpretation content, activity etc) may be used to identify change.
Measuring learning experiences at the zoo	Measures should not be onerous or time consuming as motivation to visit is most often for enjoyment.	Visitors are interested in research activities at the zoo (Bowler, 2012). Questionnaires should be short. Enjoyment may be enhanced by interactive

		or creative evaluation tasks embedded in activities (e.g. use of drawings, Bowler, 2012). Donations of tokens, signing petitions, interest in volunteering or becoming a member of the zoo is a simple means to measure impact of interpretation.
Perceptions of conservation education	Expectations and understanding of interpretation.	Media representations of a species and the specific content of images (presence of humans and unnatural environment) can impact on perception of a conservation message (e.g. Ross et al 2008, 2011). Contextual framing should be carefully considered in the design of zoo interpretation.
	Promoting social responsibility and self-efficacy in relation to conservation behaviours.	Using social norms to promote conservation behaviours may be effective in a zoo context (Clayton and Myers, 2009; Schultz et al, 2007).
Characteristics of exhibits	Naturalistic exhibits that aim to provide appropriate behavioural opportunities for animals.	Active animals enhance visitor experiences (Anderson, 2003). Attractive, neotenous, and charismatic species can be used as flagship species to enhance the salience of conservation education messages. Consider how exhibits might aim to better educate visitors about the animals and their ecosystems (Fraser, 2007).
Attitudes difficult to change		Emotional engagement can promote positive conservation attitudes (chapter 2). Conservation messages should be consistent across the site to reinforce attitudes and behaviour (e.g. signage of recycling on site; Roe, 2015). Merchandising or media content should aim to avoid representations of species which could undermine conservation messages elsewhere in the zoo (e.g. Ross et al 2008, 2011). Zoo visitors often already hold positive attitudes towards animals and conservation, while these values may be consolidated by zoo learning opportunities, this may prove hard to measure. Pre and post measures are desirable although not always practical to implement.
Learning difficult to measure		Some basic measures of visitor engagement (dwell times). Questionnaires - self report.

		Aim to identify simple behavioural measures (e.g. donation choices with tokens).
Limited evidence that conservation education activities are informed by research	Evaluation is necessary to develop and enhance conservation learning resources	Interpretation materials and strategies should be reviewed considering research findings. Evaluation of conservation education should be undertaken to measure the efficacy of strategy and implementation.
EAZA standards requires that zoos engage in research into the impact of conservation education on attitudes and behaviour.	Barriers to research due to staff time and costs, and research expertise needed may not be available.	Evaluation of conservation education should be undertaken to measure the efficacy of strategy and implementation. Zoos should foster collaborations with universities to facilitate an active research programme (e.g. RZSS Living Links is an example of best practice with research embedded in the exhibit and long-term collaborative links). Evaluation of conservation education research should be published in one open-access journal to promote best practise across the sector.

5.3. Implications of Research Findings

Human population size, growth and density are often regarded as important factors in explaining the loss of species. Alteration of habitats, over-exploitation of resources, pollution, and climate change all influence the loss of biodiversity (Cincotta and Gorenflo, 2011). With more than half of the world's population now living in urban areas this has led to the disappearance of many habitats and species, therefore limiting the opportunity for people to connect with nature. It is widely recognised that people have an emotional need to connect with animals (e.g. Biophilia hypothesis), which manifests itself in, environmental care and concern (Vining, 2003), pet keeping (Paul and Serpell, 1993), and visiting zoos (Myers, Saunders and Birjulin, 2004). Zoos have the potential to educate millions of visitors, therefore research is this area is extremely important and could be instrumental in contributing to efforts to conserve wildlife and their habitats. For example, Pearson et al (2014) evaluated a conservation education campaign, 'Don't palm us off', at a zoo in Australia to increase awareness of how palm oil plantations are threatening the survival of orangutans. Using a questionnaire to investigate knowledge and attitudes towards orangutans, support for labelling products that contain palm oil, and whether labelling would impact purchasing behaviour. The results illustrated a significant increase in self-reported conservation behaviour, which was validated by 160,000 people signing a petition for compulsory palm oil labelling on consumer products and passed onto the government. The findings of the 'Don't palm us off' campaign support the importance of developing multi-faceted approaches in the success of zoo conservation education and the positive impact on species conservation. To maximise the considerable potential of zoos to contribute to societal change on conservation, we need a more robust evidence base to inform best practise across the zoo community.

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Appendices

Chapter 4 written statements from participants attending the Safari School:

"I feel as long as the enclosures are safe and comfortable for the animals **(welfare),** I feel conservation is good for animals as it allows us to understand them better **(ex-situ conservation).** Ways to support conservation are by donating to charities, learning about animals or visiting safaris" **(conservation self-efficacy). Participant 1.**

"Conservation is good as it conserves wildlife and habitats. You can put feeders in the wild to feed animals or donate to a charity which helps conservation" **(conservation self-efficacy).Participant 2**.

"I think conservation is vital for the survival of species because humans can cause so much destruction to their population when they poach and destroy their habitats **(understanding of biodiversity)**. This can be stopped by preventing poachers from being successful and recycling more to stop pollution and litter from building up". **Participant 3**.

"Conservation is the act of conserving plants and animals. It is a good thing because it saves the lives of many animal species. It also teaches us about the many different species in the wild and captivity". **Participant 4**.

"Conservation is good, it helps to keep animals from extinction it's like protection. In the wild they get poached". **Participant 5.**

"I think conservation is very important as a drop-in species would impact our life greatly as well **(understanding of biodiversity).** I think we could help by donating, recycling and not polluting and educating people would be very helpful **(conservation self-efficacy)**. Conservation is important for future generations". **Participant 6.**

"I believe that conservation is very important to preserve species and to stop species becoming extinct **(understanding of biodiversity).** It can also help stop poaching of animals for skins or tusks or other precious or valuable animal body parts. In order to support conservation efforts donations to charities, educating young people through schools or other conservation programs **(conservation self-efficacy).** Without the work of conservation programs some amazing and vital species of animals could go extinct". **Participant 7.**

"I feel that conservation is vital in maintaining the next generation of certain species. Without conservation certain species may go extinct and impact the whole ecosystem in areas **(understanding of biodiversity).** To support conservation we can recycle, donate to charities and educate those who may be ignorant towards the plight of certain species and education (especially at a young age) can shape their viewpoints and impact the outlook the next generation have on conservation" **(conservation self-efficacy)**. **Participant 8.**

"I understand that it's really important to conserve animals and plants, and I feel that people need to look after their wildlife more and respect them more" **(emotional affiliation to animals)**. **Participant 9**.

"I feel that conservation is an important role that zoos and safari parks have to play as part of their work **(understanding of ex-situ conservation).** I feel it is important to try as hard as possible to stop or prevent the extinction of animals. By speaking about the importance of conservation and raising awareness for charities helping with conservation" **(conservation self-efficacy).** Participant 10.

"I think conservation is extremely important because animals are amazing and beautiful **(emotional affiliation to animals),** so we should save them because otherwise our planet would be bleak and lifeless **(understanding of biodiversity and aesthetic value of nature).** We need to conserve them so that our planet can continue to thrive and evolve **(understanding of biodiversity),** rather than humans destroying all other life **(understanding of anthropogenic activity)**". **Participant 11.**