Annette Scheersoi · Sue Dale Tunnicliffe
Editors

Natural History Dioramas – Traditional Exhibits for Current Educational Themes

Socio-cultural Aspects

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Foreword

Our last book, *Natural History Dioramas: History, Construction and Educational Role*, was the first book considering that natural history dioramas are one of the most effective museum exhibit genres for the teaching and learning of many aspects of biology. Dioramas have been, hitherto, a rather neglected area of museum exhibits, but they are experiencing a renaissance, and their educational potential in contributing to peoples' understanding of the natural world is becoming more and more obvious. Dioramas have proved, time and again, that they can reach a wide audience and are a vital tool in increasing the public's access to biology knowledge.

People in the museum and education field approached us about writing a second book. This book is the outcome and focuses on the role of dioramas in addressing challenges of the Anthropocene era.

Science education has been a neglected field in many stages of education with the emphasis being on language and numeracy competency development. However, the world is changing and science learning is becoming recognised as a vital component of a learning journey, especially in this present age of realisation that we humans have contributed to many of the issues facing the planet. This era is being recognised as that of the Anthropocene. Sustainable development is vital to the world, and organisations such as the United Nations have issued goals for this. The understanding of the skills of the STEM subjects (science, technology, engineering and maths) is essential in working towards the goals, together with social competencies such as teamwork, communication and flexibility.

Moreover, the importance of preschool and early years of formal schooling as well as the importance of community involvement is increasingly recognised with a vital role in facilitating learning, not only by formal instruction, but by offering informal learning opportunities. In visiting natural history museums with dioramas, all visitors can stand and stare, they can observe the 'big picture' of a whole environment of a moment in time. They may notice the interconnectedness between the earth (geology), climate (meteorology) and organisms (biology) and recognise the different habitats and adaptations of the organisms. Dioramas may also engender an emotional response to our planet and connect the visitors to the issues facing our world at the present time.

This book brings together a collection of voices from different fields that are all associated with natural history dioramas: curators, taxidermists, educators and scientists, all using their expertise to discuss relevant issues from many perspectives and angles.

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Chapter 1
Introduction: Natural History Dioramas and Socio-cultural Aspects

Annette Scheersoi and Sue Dale Tunnicliffe

Museums are now regarded as almost the last public space left available to all. They should view themselves as communal meeting places, in which people can even discuss controversial issues (Sharp 2016). Museums can act as facilitators of communication and collaboration between scientists and the general public on issues of the twenty-first century including natural and social sciences (Garthe 2018).

Natural history dioramas, with their taxidermied animals and representations of (authentic) habitats, can help us to visualise the consequences of human activity by addressing environmental issues (Wonders 2016). They provide opportunities for, and often spark debates, to talk about relevant controversial topics such as climate change, global warming, loss of habitat, industrial pollution and the dominance of one particular species, *Homo sapiens*, over many others, in some cases to the point of extinction.

Originally, natural history dioramas were a nineteenth century development, but they have evolved into institutions for both researching biodiversity and more recently focusing on the changes during the Anthropocene era (Crutzen 2002) – and how such information can be effectively accessed and understood by visitors.

One view of museums is that they are places for learning aspects, in this case of biology, and thus considered a venue that benefits school groups in particular, brought for curricula reasons, as well as the general public. The transmission mode of learning requires the receiver to consciously participate in the transmission. Indeed, Vygotsky (1986) suggested that 'any function in a child's cultural development appears twice, or on two planes, first it appears on the social plane and then on the psychological' (p. 16). Following this line of thinking, educators could recognise

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the importance of social interaction, talk or dialogic dialogue (Alexander 2008), particularly in working with school groups visiting museums in the widest sense, as well as in schools. Museums increasingly recognise that socio-cultural exchanges are both between the visitors with all their pre-visit understanding through which they interpret the exhibits, between generations, social classes, peers of the groups and other visitors, as well as museum personnel.

Museums of all genres have, as one of their missions, to foster understanding of the subject focus of the museum, be it arts or science. However, Anderson (2016) identifies barriers and inhibitors, which exist and render this missions' intent more difficult. He argues that first of all, in the museum itself, educators, scientists, in-house consultants as well as exhibit designers, might hold differing expectations of outcomes. Anderson further asserts that there are mismatches in museum pedagogy, which limit the effectiveness of science museums as cultural resources for learning. These barriers counteract the museums' main goals. He suggests that museums need to recognise the distinct cultures to which museums' visitors belong, in order to understand the way in which they interpret the exhibits. Thus, museums need to identify their audience and tailor their pedagogies to allow for such variation. Museum visitors are recognised as being a widely heterogeneous group, ranging from families with young children, adult groups, leisure visitors to those of formal and adult education groups, particularly in the case of science museums in the broadest sense. One-size initiatives do not 'fit all'. Hence, a progressive understanding of the changing profile of visitors and their interpretation is an essential part for museums in order to develop an accurate view of their audiences.

In applying Western research to other areas of the world, the culture and context of the local setting needs to be taken into consideration. Those of us who have worked with comments generated at similar exhibits, but in other countries, can recognise such a mismatch. Research findings from one country cannot be adapted to another without establishing whether there are such differences. Even in the same country or even in the same city, visitors have differing life experiences and understandings of the subject and interpret the exhibits for themselves.

It has been shown that dioramas provide constructive learning opportunities for a wide range of visitors: If a diorama provides a variety of anchor points it enables visitors to relate their previous experiences and knowledge to the scenes or artefacts presented. It often results in visitors' feelings of enjoyment, involvement, and stimulation, which are the most typical emotional aspects of an interest-based activity (Scheersoi 2015). Tunnicliffe and Scheersoi (2010) maintain that the focus of intervention initiatives should be on accurate minds-on observations, rather than pure physical hands-on manipulation of objects, inviting the observer to ask questions. Facilitators, employed by the museum, or members of a visiting group can encourage minds-on focus at dioramas and, through using appropriate 'talk', assist others in developing understanding.

We recognise that the cognitive domain is as important as the affective domain and that visitors enter museums with a variety of agendas and reasons for their visits, many of which do not openly involve learning but have social foci. Hence, in this book, we assembled contributions that are focused on affective learning opportunities,

such as reflections of visitors and their experience of viewing natural history dioramas.

Dioramas are an established form of exhibit in museums, bearing both cultural and scientific significance, particularly in natural history museums. They are windows into a natural or a human constructed world, depicting the past or the present and sometimes even pointing to the future. Hence, they are fascinating for visitors and many educators consider dioramas to be essential learning tools. They are 'minds-on' exhibits as opposed to 'hands-on' in which the physical interaction frequently becomes the exhibit. Reiss and Tunnicliffe (2011) made the case for biological dioramas but also point out that there is scant literature about such, although it is increasing, e.g. Tunnicliffe and Scheersoi (2015). Another recent diorama book edited by Gall and Trischler (2016) is mainly devoted to other types of dioramas, e.g. modeled scenes in science museums, but also includes some chapters dealing with natural history dioramas.

Natural history dioramas are again increasingly recognized as a valued genre of exhibit.

Nevertheless, inexperienced museum staff is one of the biggest issues in creating and preserving dioramas for future generations, and can lead to the dioramas' destruction. Practitioner knowledge and academic theory have to be both joined in contemporary habitat diorama artistry and exhibition planning. The major challenge is to bring together curators, exhibitions designers, taxidermists and model makers, educators and scientists, all using their individual skills and expertise and working hand in hand. In this book, we bring together a collection of voices from such experts in different fields that are all associated with natural history dioramas to discuss relevant issues from many perspectives.

Two books are simultaneously published. While the book at hand focuses on socio-cultural issues, our second book discusses the history of dioramas and their building and is particularly concerned with science educational aspects, as well as current developments and the diorama's place in the visitor experience.

The first section of this book with its five chapters focuses on different types of audience.

Gkouskou from University of East London and *Tunnicliffe* from University College London Institute of Education (UK) focus on the responses of adult leisure visitors to natural history dioramas. They were either asked to talk about the diorama and to describe their memories or to respond to a written questionnaire provided at the exit. There was a variation in responses depending on the age of the visitors.

Macdonald, *Altman*, and *Holmes* from the American Museum of Natural History New York and Bank Street College (USA) write about a collaborative research that examined the potential of dioramas, for teaching science content to students new to North America, who do not speak English. Their findings demonstrate how different aspects of the dioramas inspired multiple science projects in schools.

Neitscher and *Kettenhofen* from Museum Alexander Koenig in Bonn (Germany) present their project "MuseobilBOX", which uses dioramas to facilitate access to biological themes for educationally disadvantaged children. The project's aim was to help these children realise, through interactive activities, exploring the stories in

the museum dioramas and creating their own dioramas, that the museum can be an exciting place to learn about the natural world.

Gabriel from the San Diego Natural History Museum (USA) writes about a case study of their permanent exhibition Fossil Mysteries, focusing on three distinct groups of visitors – those with ADHD, dyslexia, and high-functioning autism. He offers specific recommendations to museums about how and why dioramas are working well for the brains of all visitors, and how to enhance their power to attract and engage.

Gambini from University of Milan (Italy) describes an innovative approach to engaging audiences and exploring natural history dioramas outside a museum setting, e.g. in schools, by applying the Digital Diorama, a multimedia interactive interface that employs specific software working on the interactive white board (IWB). This approach might help to stimulate a true awareness of the complexity of environmental problems. The Digital Diorama is an Italian project funded by the Government.

The second section of this book considers problematic aspects of dioramas, such as life and death, presenting indigenous cultures and cultural influences in interpretation.

Meehitiya from Cultural Innovations Ltd. (UK), *Sanders* (University of Göteborg, Sweden) and *Hohenstein* from King's College London (UK) studied how dioramas with taxidermically prepared animals influence visiting families' perceptions on the concepts of life and death, and their potential for learning conversations. The authors also discuss studies to facilitate a new interdisciplinary relationship between museum curators and researchers, thus contributing to a debate on the value of natural history collections in modern society.

Ash from University of California, Santa Cruz (USA) addresses another problematic aspect of dioramas. Dioramas depiciting indigenous or enslaved people were originally designed to convey selected aspects of past or present cultures; the specific selection was made by the museum and its staff, sometimes in collaboration with the cultures being shown, but often not. The examples chosen here (Native American, African American and South African Bushmen) all share the experience of having had their cultural realities interpreted by the museum and misrepresented.

Achiam from Denmark (University of Copenhagen) and *Marandino* from Brazil (University of Sao Paolo) discuss how dioramas are influenced by conditions and constraints that originate both inside and outside the natural history museum. These conditions and constraints are illustrated by reference to two dioramas, one from Brazil and one from Denmark, and vary considerably, both between institutions and within institutions. The authors point out how this has consequences for how the dioramas are perceived by learners.

Section three is concerned with connecting people with our living world in this Anthropocene age with continual loss of biodiversity and degradation of the natural environment.

McGhie from the Manchester Museum, University of Manchester (UK), suggests that museums are an ideal place to support peoples' connections with nature.

The chapter explores the proposition that natural history museums can support their visitors in developing their own understanding of nature, to appreciate its value, and to have a positive attitude to their surroundings. The proposition is explored in regard to dioramas and diorama-making.

Scheersoi and *Weiser* from University of Bonn (Germany) discovered that visitors recognize ecological aspects (e.g. relationships) in dioramas, but that only a few visitors spontaneously identify ecosystem perturbations or conservation biology issues. However, when specific cues are provided, the visitors do discuss the human impact on nature and conservation actions. Visits to specific natural history dioramas can therefore increase visitors' ecological awareness and knowledge, as well as their affective connection to nature.

Dunmall (UK) outlines how a temporary exhibition in the Powell Cotton Museum (Kent) changed the discourse around a series of dioramas. A transdisciplinary team intervened in the content of the dioramas by highlighting the endangered status of certain animals. This action enabled discussions around extinction and climate change among a contemporary audience.

Marandino, *Bueno*, *Achiam* (University of Copenhagen, DK) and *Laurini* from Brazil (University of Sao Paolo) write about one of the biggest challenges of museums; exposing issues related to biodiversity, arousing interest in visitors and promoting their understanding. They collected data in two zoological museums, one in Brazil (Museu de Zoologia of University of São Paulo) and one in Denmark (Zoologisk Museum, University of Copenhagen) and discuss the potential of dioramas to teach aspects of biodiversity.

Reiss from University College London Institute of Education (UK) concludes this book considering the extent to which the chapters highlight the importance of socio-cultural issues for natural history dioramas and vice versa the importance of natural history dioramas for socio-cultural issues.

The second book (Natural History Dioramas – Traditional Exhibits for Current Educational Themes, *Science Educational Aspects*) includes chapters from curators, taxidermists, educators and scientists all using their expertise to discuss the role and potential of natural history dioramas from many perspectives and angles.

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Annette Scheersoi is a Professor in Biology Education at the University of Bonn (D). Her doctorate was on museum's exhibition concepts and the use of different media for communicating biological knowledge. Since 2005 she is a biology teacher-trainer and researcher, first at Frankfurt University, then at the University of Cologne and now at Bonn's university. Her research on biology learning focuses on interest development in out-of-school learning environments. Annette also develops learning materials for schools as well as for museums, zoos and botanic gardens.

Sue Dale Tunnicliffe is a Reader in Science Education at UCL Institute of Education, University College London. She holds a bachelors degree from Westfield College, University of London in Zoology and trained as a secondary biology teacher at the university's Institute of Education. After teaching in grammar schools for a few years she had children and, wanting to find out more about how young children learnt science, particularly biology, she entered primary school teaching and is now interested in pre school learning, as well as animals as exhibits. She set up and ran a new Primary Science and Design Technology advisory team for London Borough of Richmond and then became Head of Education at the Zoological Society of London. She has worked at the BBC and in a cultural museum. Her doctorate was from King's College, London "Talking about animals: conversations of children in zoos, a museum and a farm". She has published widely.

Part I
Reaching Different Types of Audiences Through Dioramas

Chapter 2
Leisure Visitor's Responses to Natural History Dioramas

Eirini Gkouskou and Sue Dale Tunnicliffe

2.1 Reflections

Why do people make a visit to a house with a natural history museum attached in Southern England? How do they interpret what they see? Are memories evoked through viewing the scenes in the dioramas? This chapter examines peoples' reasons regarding a visit to a museum, and their responses do indeed vary (Falk 2009). Visitors assume one or several identities during the course of a visit (Doering and Pekarik 1996), yet museums with artefacts can elicit memories too. Museums, and other locations such as zoos and galleries, are seeking to adapt to the challenges that an ageing populations presents, but also to the opportunities which are presented for authentic related narratives. Such emerging opportunities are discussed in the collected writings of specialised authorities in 'The Caring Museums' (Robertson 2015).

The study of museums of Natural History is considered particularly critical because visitors seem to acquire much of their knowledge on the world around them (Monhardt and Monhardt 2006). The museum visitors may take advantage of the rich context of the museum and use it to develop more processed reasoning. Gilbert et al. (1985) claim that the learning experience in a non-formal setting, compared to a formal setting, has different characteristics. Various researchers (Fleer 1994; Allen 2004; Tunnicliffe 1995; Fenichel and Schweingruber 2009) claim that this research area seems particularly fertile, both pedagogically and methodologically. Moreover, the present research focused on natural history museums and their dioramas and the interventions which bring the visitors together with the museum environment and usually have very encouraging results by recalling

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memories and previous experiences in the cognitive and emotional resources of visitors (Hooper-Greenhill 1994; Hofstein and Rosenfield 1996; Tunnicliffe et al. 1997; Tunnicliffe and Reiss 1999; Mathewson 2001; Anderson et al. 2003; Griffin 2004; Martin 2004; Eshach 2006, 2007; Packer 2008; Alexander 2008; Rix and McSorley 2010).

We were interested in the rationale and responses of the widely differing visitors identifiable through age, particularly those of leisure visitors who chose to make a visit to Quex Park and the Powell-Cotton Museum (Kent, England), which exhibits natural history dioramas of Africa and India. The visitors ranged from teenagers, who visited by themselves and/or with their peers and/or families, to older couples, family groups and pensioners.

Reminiscence work in museums has been shown to have beneficial effects for visitors of older years. Such reminiscences often interest younger visitors too. Wellbeing of the population is discussed more and more and the social role of the museums is a subject in which there is increasing interest and recognition (Griffin 1998). When intergenerational groups visit together each visitor has varied relevant knowledge and memories with which to interpret the items being viewed. Older adults often take such an opportunity to explain in didactic manner the theory to younger people. This phenomenon is frequently observed in science centres at exhibits showing particular physical concepts. Adults have been observed 'text echoing' (McManus 1988), which is reading aloud the text to the rest of their group, an activity in which chaperone and teachers take part when leading school groups. Thus, we hypothesised that younger visitors would be very factual in their short replies and have few memories that were evoked but that older visitors, as had been found in museums (Tunnicliffe 1995), particularly those bringing grandchildren had rich memories with which they were interpreting the animals and scenes on display. For example, grandparents with two pre-secondary school-aged children viewing a polar bear included in an exhibit in the Natural History Museum London asked their children whether they remember the stories their parents told of the bear that they had seen on a cruise to the Arctic. A mother told her sons, at an exit to an exhibit of Australian wild life in a museum in the UK, about how their great grandfather had worked his passage to Australia seeking gold in the Kalgoorlie region and how she had seen so many wallabies when she herself had visited Australia.

Museums are a place where visitors can reflect. They may reflect on the subject being presented to them; they may reflect on its impact made relevant to them. Alternatively, they may reflect on the past memories the stimulus elicits. Perhaps museum exhibits can bring back information, either learnt in school or during their lifetime, which have since been forgotten.

2.2 The Natural History Museum and its Visitors

Natural history museums are frameworks for learning natural sciences in the field (Paris et al. 1998; Rix and McSorley 2010; Tran 2007). Their visitors participate either on constructive or individual activities which are implemented through the interest and selection of participants (Ramey-Gassert 1997; Henderson and Atencio 2007). In recent decades, several theories were developed in order to clarify the relationship between the museum and its visitors. The information in the messages transmitted can lead the visitor to feel comfortable and either encourage a desire to return or prevent a possible future visit (Diamond 1991, 2000).

The positive experience of a visit to a museum and the habits formed during the visit are encouraging, especially for pre-schoolers, to return to the museum as adult visitors. Bell et al. (2009) state that environments such as natural history museums provide visitors with enthusiasm and positive emotional reactions. There are clear indications that participants are concerned with both the content of science and their own thinking about science. The visit to a natural history museum may reinforce what visitors already know (Falk and Storksdieck 2009) and, with the variety of understanding of these visitors, some know quite a bit more than others (Falk and Dierking 2000). Allen (2004) argues that in environments such as museums of natural history, cognitive and emotional progress and learning may become a pleasure for visitors of different ages. Piscitelli and Anderson (2001) and Anderson et al. (1997) examined the learning of young children at museums through multiple levels that include socio-cultural education, knowledge, learning style, motivation and collaborative learning. Hence, Piscitelli and Anderson (2001) concluded that the most important memories of children from museum visits were about exhibits in this museum on display. Surveys showed that planned experiences and visiting museums in scenarios where children actively participate and/or acted through planned activities can enhance and contribute more to the process of learning. The shared experiences between age groups may lead to the establishment of training programmes mainly for museums of natural sciences (Miglietta et al. 2008; DeWitt and Storksdieck 2008; Groundwater-Smith and Kelly 2010).

2.3 Visitors' Agenda

Visitors usually enter a museum with some ideas of what they want to see. Moussouri (1997) and Falk et al. (1998) identify five factors as determining the family museum agenda. According to our research studies some of the factors are applied to the visitors' agenda as well. So, Fig. 2.1 presents a representation of Moussouri (1997) but focuses on the visitor's agenda. The first factor is the visitor's profile. Knowledge about a visitor's background, age and gender allows us to deduce their motivation for visiting the museum. The socio-cultural patterns refer to the functions a particular museum is perceived to serve in the social life of their visitors. The personal

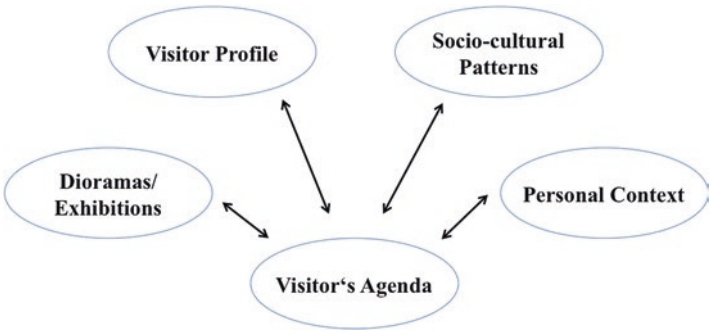

Fig. 2.1 Factors determining the family museum agenda

context of the visit here is being used, as Moussouri (1997) points out, to try to explain the expectations of the visitor. Finally, she points out that the Dioramas/exhibitions involve the subject that is being presented in the museum, its physical characteristics and the media of communication used.

Natural history museums are usually large institutions which were created during the nineteenth century and varied depending on the focus of the available collections and the scientific knowledge explained (Mironer 1996; De Clercq 2005; Adams 2007; Langebek 2011). This type of museum did not take into account the requirements of the general public but advanced the science dogmatically only to a specialized public (Hein 1998). In recent decades, a trend of these natural history museums is to restructure their material to make communication more effective and to establish privileged relations with the formal education sector (schools and universities) to (re)-plan their education policy (Piscitelli et al. 2003; Diamond 2000; Friedman 2010).

A visit to a museum of natural history is an experience having both educational and leisure aspects (Tunnicliffe and Scheersoi 2011; Patrick and Tunnicliffe 2013). The experience offers visitors unique opportunities (Falk and Dierking 2000; Piscitelli and Anderson 2001; Schmitt-Scheersoi et al. 2002; Dewitt and Hohenstein 2010). These museums are excellent sources of cognitive experiences that complement and/or enrich the agenda of each visitor (Kelly and Fitzgerald 2011). Thus, the visit experience in a natural history museum may provide both adults and children visitors with the opportunity to become more observant and develop their curiosity. Visitors have reported that natural history museums helped them to observe things in the outer world that they had previously ignored (Griffin 2004; Patrick and Tunnicliffe 2013).

2.4 The Galleries of the Powell–Cotton Museum

In the study reported here we were interested in the responses of visitors who came to the Powell-Cotton Museum at Quex Park (Kent, England). This English gentleman's residence has been in the ownership of the same family since the 1550s. The present regency style house was built and completed in 1813 after the original building was knocked down. This house was enlarged in 1883 by the father of the founder of the natural history museum to accommodate his growing family. The house has formal gardens and is in a 250-acre park. The Powell-Cotton Natural History Museum, whose strap line is: "Where the past meets the present to change the future" (Powell-Cotton Museum 2016), was built by Major Percy Powell-Cotton "a pioneer in the use of the diorama to display mounted animals against backdrops of their natural habitats" to house the specimens of animals from Africa and India that he collected and, after being taxidermically treated, brought back to this part of England (Powell-Cotton Museum 2016). He wanted to show the local people, in the days before mass media, the diversity of living organisms and indeed various habitats to which the animals were adapted. Indeed, older local residents talked to his granddaughter, now living at Quex Park with her family, about their memories of witnessing the arrival of the mounted specimens brought down by road from London from the par excellence, taxidermist, Rowland Ward. The arrival was signaled by the ringing of the church bell. Compared with the local endemic wildlife of subdued hues, these exotic colorful animals, particularly the giraffe, lions and zebra were a wondrous invasion of colour to the locals, who lined the streets to witness the arrival of the latest animals (S. Johnson, personal communication, March 26, 2015). The natural history museum has 3 galleries including a variety of species.

Gallery 1 (Fig. 2.2) is displaying the animals of north and west Africa and India. Today, this is the first gallery visitors see on entering the museum but it was actually the last gallery built by Percy Powell-Cotton himself, being competed in 1939 the year before his death. The large diorama to the left, known as 'The Watering Hole', represents many species from across northern Nigeria and Chad. The central diorama showcases the amazing diversity of Africa's primates and the different landscapes they live in. The diorama to the back right of the gallery depicts animals

Fig. 2.2 The Dioramas in the Primate Gallery (Gallery 1). Copyright Nikhilesh Havel. (Reproduced courtesy of the Trustees of the Powell-Cotton Museum)

from the Indian state of Madya Pradesh (which translates as 'Central Province'). The final diorama, to the right of the gallery, incorporates a variety of landscapes and animal habitats. The far left represents the more lush woodlands around the Mkuze River, in northern KwaZulu-Natal, South Africa. The central part of the diorama, formed of a high rocky crag, represents the Ethiopian Highlands, an area where land levels rarely fall below 1500 meters. The Mountain Nyala displayed here, are only found in this region and have become a rare and endangered species. Finally, the desert habitat at the front of the case showcases the diversity of species found in the Sahara Desert (Powell-Cotton Museum 2015a).

Gallery 2 (Fig. 2.3) called 'The Pavilion' was the first gallery designed and built by Percy Powell-Cotton and the starting point for his relationship with the taxidermist Rowland Ward, who helped build and design the museum's famous natural history dioramas. The gallery was completed in 1905 and the large Himalayan diorama is now considered the oldest untouched diorama of its type in any museum around the world. The diorama depicts the Himalayan landscape at dawn. The painted scenery looks down on the Baltoro Glacier, which is found today in the Gilgit-Baltistan region of Pakistan. Dioramas such as this were a new and innovative

Fig. 2.3 The Kashmir Diorama in Gallery 2. Copyright Nikhilesh Havel. (Reproduced courtesy of the Trustees of the Powell-Cotton Museum)

Fig. 2.4 Angola Diorama in Gallery 3. Copyright Nikhilesh Havel. (Reproduced courtesy of the Trustees of the Powell-Cotton Museum)

way of displaying natural history in the late nineteenth and early twentieth centuries and very few dioramas of this quality or age are still standing in museums worldwide (Powell-Cotton Museum 2015b).

Gallery 3 (Fig. 2.4) was the second gallery to be built, added on to the 'Pavilion' in 1909. The dioramas in this gallery focus on species from equatorial Africa and the plains at the edge of these forested areas. The central diorama represents a lion and a buffalo, locked in battle. The large diorama of animals from equatorial Africa include one of the most impressive specimens - the large bull elephant to the left of the case. In the same case is a truly rare sight – a group of Northern White rhino (*Ceratotherium simum cottoni).* The side wall diorama is of an Angolan scene (Powell-Cotton Museum 2015c).

2.5 Methodology

We focused our work on the responses of visitors of all ages: formal school groups visiting as part of their curricula studies and informal visitors. We wondered whether the response of non-educationally focused visitors was similar across the age groups or whether there were differences. Our interest arouses from informal conversations with visitors and in particular noticing that Powell-Cotton had a number of senior visitors (possibly aged over 50). Seniors and retirees were quite frequent visitors at that time partly because tea dances were run in the mid afternoon in the winter months. Accordingly, we decided to design and collect voluntary responses to a questionnaire. One of the volunteers of Quex Park offered to ask visitors at some weekends if they would fill in a questionnaire. More often she used the questionnaire as a template and verbally asked the questions, as we had noticed a number visitors reluctant to write answers after their visit. However, piles of blank questionnaires were also left at the entrance of the museum and some completed sheets were

handed in. Such data could usefully be further analysed, looking for clusters of interest. This became apparent in our reread of the summary of responses.

We based the content of the questionnaire on topics that occurred to us after having listened to a range of visitors and their comments. In some instances, we carried out open-ended interviews with visitors, which are not reported here, where anecdotal memories and associations with other events in their previous life were often a focus of their comments. One example was the retired lady who had been a midwife in Southern Rhodesia (now Zimbabwe), saying one of the dioramas (Fig. 2.4) particularly reminded her of the bush in the area where she had worked. Another gentleman, actually looking at ceramics in another gallery of the museum en route to look round the House, said his visits to the dioramas had not particularly interested him. However, he then went on to talk about serving in the British Army in Afghanistan and other parts of the world and how the animals in the desert-like dioramas had reminded him of these countries.

We compiled a summary and table of the responses and then analysed the content of the main headings columns as well as adding the demographic questions.

The questions were, *age range*, *gender* and *gallery.* Then the visitors were asked, verbally or through the written questionnaire, various questions regarding their interpretation with the dioramas of Powell-Cotton Museum. More specifically:

Please describe the dioramas you are looking at.
Can you see a story? What is it?
How do these dioramas make you feel?
Do these dioramas bring back any memories?

We are very conscious that unlike spontaneous dialogue and remarks said out loud, structured questions, albeit open-ended, does encourage the respondent into a topic about which they may well not have themselves thought. Although, the responses are elicited after the visitors have looked at the exhibits, they are very likely to have been influenced by the visitors' own knowledge and interpretation of what they have seen (Table 2.1).

2.6 Results

When visitors look at exhibits, especially dioramas, varied types of conversations are present, which locate, identify, describe and interpret the content. Visitors attended the Powell-Cotton Museum on different days and conversation units and responses were collected via the questionnaires of the dioramas in the galleries 1, 2 and 3. These research units were analysed in this research.

Females were the largest number of respondent (47), followed numerically by males (30) and others who didn't indicate on the sheet (Fig. 2.5). A total of 80 questionnaires were collected in.

Figure 2.6 indicates the age range of the authors of collected questionnaires. 44 of adult visitors responding were over 40 years of age.

The majority of questionnaires were completed referring to Gallery 1, the first gallery to be encountered once visitors had entered the Powell-Cotton Museum (Fig. 2.7).

The second question was about the 'story' of the diorama. Seven visitors did not respond. Table 2.2 of respondents' comments to the question asking what was "the story" in the diorama, were mostly focused on the dioramas in gallery one, namely a long African diorama, a compilation of primates on the end wall and several smaller dioramas, of India, one featuring a tiger in the foreground and a bear further back and one a desert with rocks.

Table 2.3 presents the way the dioramas make the visitors feel. Visitors have positive and negative feeling while they are looking at the dioramas.

Table 2.4 presents the responses of the visitors regarding their memories. The majority of respondents had memories evoked by looking at the dioramas. Of the 17 respondents who described it, 10 were in the under 29 years, all but 2 under 19 whilst 4 were in the older age groups. Three were female in 40–49-age range.

2.7 Discussion

Several responses lamented the killing of the animal for display but did not comment on the cultural context and different attitudes of the times when the specimens were collected. The motivation of Powell-Cotton in the days of little overseas travel, except for the wealthy, and no media was to bring such information to most people unable to travel and see the biodiversity of other countries for themselves. Such information was presented in the museum.

Analysis by read–reread technique of these data show that the responses from younger visitors were very factual and revealed few memories. Conversely the older

Fig. 2.5 The distribution of gender responding to questionnaire

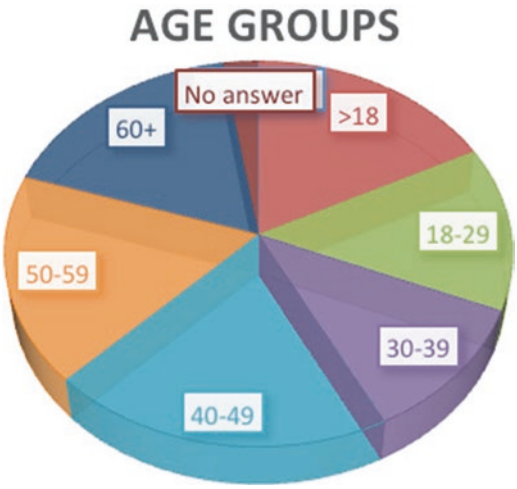

Fig. 2.6 The distribution of age responding to questionnaire

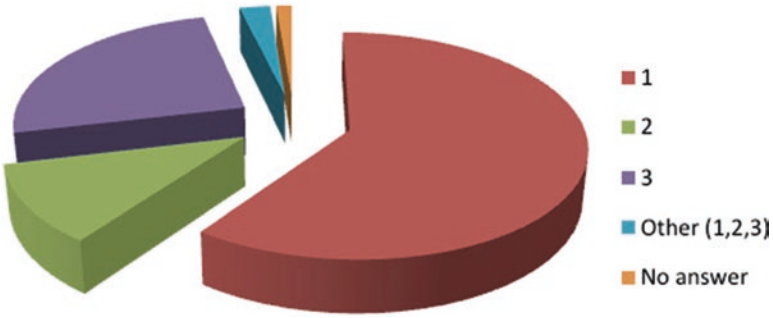

Fig. 2.7 The distribution of the preferred Gallery

visitors had rich memories to associate with the natural history dioramas, either from personal experience or from wildlife documentaries seen on the media. Quex and the Powell-Cotton Museum have visitors from the locality, from further away on holiday in the locality and some who had visited before in childhood and were making a return.

The appreciation of the skill of the taxidermist views voiced by some visitors and the realistic appearance of the scenes with the animals' 'as if they' would pop out', 'made me want to touch them' testifies to the skill of not only Powell-Cotton in choosing the specimens and making notes on their habitat but also on the skill of the taxidermists, whose art can create this realism or absolutely spoil the illusion.

We believe that dioramas, particular those with a historical legacy, having been constructed in different times when the viewing of exotic animals, habitats and geography were unavailable to the vast majority, can also provide insights for visitors in geographical and geological aspects of the environment. Such is an area much neglected. The American Museums of New York (AMNH) do study

Table 2.1 Responses to the request: "Please describe the dioramas you are looking at"

Categories	Number of responses	Example of comments
Mentions animals (specific every day or scientific name).	28	'I am looking at giraffe, zebra and other grazing animals.', 'Primates'
Mentions geographical location	10	'Animals in Africa', 'Kashmir scene'
A natural environment	6	'Animals in a natural habitat' 'desiccated environment'
Describes geographical features	4	'Mountains and ranges', 'desert'
A Ecosystem/habitat e.g. rainforest, jungle setting	8	'A savannah scene', 'Tiger in rainforest growling at unseen'
Descriptive	12	'Large number of species', 'lots, 'Big animals'
Type of display	3	'Well many heads'
Affective comments	9	'Amazing display', 'beautiful', 'harsh'
Endangered status/conservation	2	Endangered tigers

Table 2.2 Reponses to the question: "Can you see a story? What is it?"

Categories	Number of response	Examples of comments
Descriptive predominantly behaviour	21	'Antelopes climbing up rock face', 'Tiger wandering off', 'animals looking for food'
Adaptation to environment	3	'How colours of coats of animals, Reflects the colours of their surroundings'
Anthropomorphic comments	11	'A rhino's party!', 'They want to be left alone in peace', 'symbolic of hunting'
Affective comments	3	'Sad these animals were hunted…'
Biological ideas e.g. predator prey, circle of life	11	'The predator/prey relationship of the natural world "Startled deer looking for a predator'
		'relationship between predator and prey' 'Nature is diverse' 'survival'
Tells a story, not expanded	2	
Political	1	'Could be interpreted in different way (Kashmir diorama G.2) Hostilities between Russia, India, Scotland'.
Other	9	'Pictures of African life' 'full of a variety of; potential scenes'
Conservation of species		
Habitat/geography	4	'Low and highland, Scotland, Russia, India', 'jungle'

meteorology as well as the changes in habitats featured in their dioramas (Holmes 2009). Climate change effects and the changes in endemic ecology should also be studied.

Natural history museums carry out a considerable amount of research and their collections are extremely valuable particularly to scientists, yet little of this work is

Table 2.3 Responses to the question: "How do these dioramas make you feel?"

Categories	Number of responses	Examples of comments
Affective comments		
a) Negative emotions	18	'Sad these animals were hunted', 'Creeps me out', 'Some of the creatures are scary'
b) Positive emotions	15	'Made me smile', 'in awe', 'Appreciation of why the animals had to die,' 'I always find it fascinating.'
Biological conservation	5	'Appreciate now they are endangered', 'These animals are disappearing', 'Some of these animals are threatened with extinction'.
Skill of the makers	6	'Incredible skill of the taxidermists', 'Glad they have been so well preserved', 'incredibly slick taxidermy makes a wonderful centre piece'
		'Privilege to see such skilful work.'
Reflective	4	'Their existence (the taxidermic animals) discards the need to keep collecting', 'Intrigued how came back from Africa', 'How clever nature is'.
Realist	6	'Amazingly real' like that animals are about to pop out' (at you)'; 'How real they seem', 'Background noises'.

Table 2.4 Responses to the question: "Do these dioramas bring back any memories?"

Categories	Number of responses	Examples of comments
Repeat visit to this museum		
a) As adults	1	'Yes, I have been several times, I love it'
b) Visits as child	10	'When I first came to the museum about 20 years go', 'Visiting as children when I was here when I was 1'.
Lived/visited Africa	11	'Yes, of South Africa, smells and noises', 'having breakfast with an elephant came back', 'Memories'.
Viewing media	8	'What I have watched in wildlife documentaries', 'The TV', 'Lion King (Film)', 'Jungle book, Baloo'
Visits to Zoo/ safari parks	10	'Much better than zoos, you can see each animal in close up, it's brilliant', 'London Zoo', 'Longleat' (a safari park).
Seeing animal in the wild	2	'Hogs in Poland'
Biological ideas	3	'The changing coats of animals response to different seasons'
Other	4	'wrestling with my brother'

shared with visitors. If museums and their dioramas are engaged to aid in outreach, enhancing the public understanding of crucial biological issues, as well providing an enjoyable and aesthetically pleasing experience, this outreach role could be considered further. Some of the visitors in this small pilot study looking at dioramas were relating the diorama contents to the status of the species depicted in the present

day and more information could be provided to heighten awareness of the issues amongst other visitors.

However, visitors are not a distinct single entity in terms of interest, rationale for visits or knowledge of the scientific issues that are presented. Hence, one size of interpretation does not 'fit all', and the challenge of museums is to provide a mediating focus to these different visitor genres and identities, a challenge indeed of the twenty-first century.

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Chapter 3
Learning to Teach Newcomer Students Using Dioramas of North America

Maritza Macdonald, Roberta Altman, and Jay Holmes

3.1 Introduction and Framework for Course on Learning to Teach in Museums

This chapter illustrates a "learning to teach with dioramas" qualitative story by museum-based teacher educators. The chapter is organized into five parts: (a) an introduction providing the theoretical framework for learning to teach in museums, (b) "The Story" – a qualitative narrative of observations and conversations in the Hall of North American Mammals; (c) a curriculum-driven focus group; (d) the end-of-semester teacher projects; (e) and a profile of newcomer students in a New York City High School.

The ongoing educational needs and interests of most newcomer students in urban settings seem to depend on the mastery of a new language and on their abilities to get around their new city and its services in order to help their families adapt and survive. However, when they're faced with the pressure of learning academic content and obtaining a broad knowledge of their new country, additional resources and institutions can play a big role.

In response to the challenges of how best to provide opportunities to learn outside of classrooms and increase opportunities to learn, the cultural institutions in New York City have developed a variety of partnerships and fiscal arrangements to work with colleges, universities, and with other cultural institutions to support students, their teachers, and their families across the city.

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This chapter reveals the collaborative work of three museum educators who work at the American Museum of Natural History (AMNH). They have different areas of expertise. Macdonald is a teacher educator and researcher, Altman is an art and museum educator at Bank Street College, and Holmes is a science educator with expertise in geology and biology, who often co-teaches courses, develops professional development for teachers, and continues to explore the concept of place-based learning as applied to museum learning. This story is a composite of strategies and assignments for these museum-based courses over the past 5–8 years. AMNH offers these courses to teachers attending Teachers College at Columbia University, Barnard College, Bank Street College of Education, and Lehman College of the City University of New York. We also teach a course on Applied Research on Informal Science Settings for candidates attending the Museum's own degree-granting teacher education program (American Museum of Natural History 2016).

The methodologies for the courses and research on teachers learning in museums are based on two broad theoretical foundations: teacher knowledge and science learning in informal environments. In *Preparing Teachers for a Changing World*, Darling Hammond and Bransford (2005), summarize the extensive research on teacher knowledge base that comprises knowledge of students and community (who), knowledge of required content (what), pedagogical knowledge to teach the content (how); and teachers' beliefs in the importance of education for all. Similarly, we find that the National Research Council (2009) research summaries on learning science in informal environments highlights the importance of engagement and motivation, thinking and using tools of science, and identifying with the work of scientists. In addition, we have found that in this story we have had to use aesthetics and place-based learning strategies and perspectives to interpret our findings.

Considering these perspectives and our particular interest in newcomers to North America, we selected to use the Hall of North American Mammals. From its inception in 1869, the American Museum of Natural History has dedicated its collections, resources and research to educational endeavors. Exhibitions and Programs are designed to align with the museum's mission statement: "To discover, interpret, and disseminate—through scientific research and education—knowledge about human cultures, the natural world, and the universe".

This exhibit has the potential of inspiring teachers' own motivations and helps them to explore how they may use it with students. We focused on single questions, such as, "How may you use this exhibit with newcomers to North America?" We thought there would be geographical, aesthetic, and scientific pathways to be discovered. The exhibit portrays regions from Canada to Mexico, including beautifully depicted boreal forests, deserts and grasslands; temperate, tropical and subtropical forests; tundra and snow covered mountains. We know that long-lasting personal connections can be made through the affective responses people have when viewing dioramas (Berleant 1992). The tradition of representing the natural beauty of the world, beautifully, has been part of AMNH's purpose and philosophy from the very beginning. Great care is taken to represent the settings within the dioramas with both stunning accuracy and exquisite care for subtle nuances. Artistry is combined

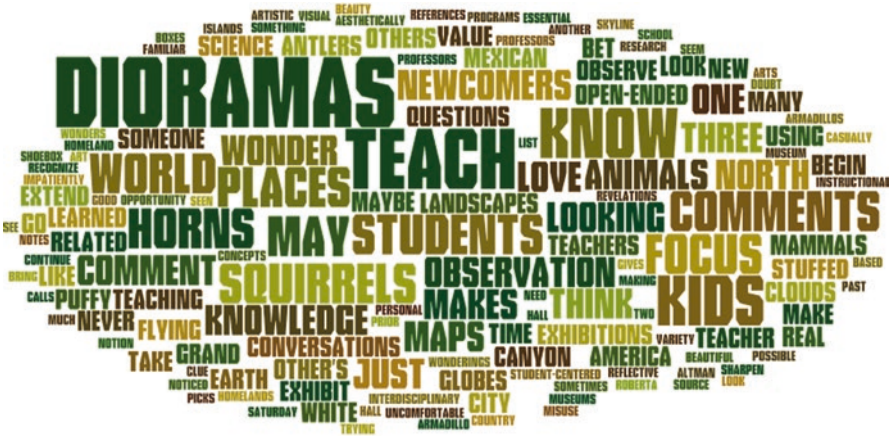

Fig. 3.1 Dioramas engage many thoughts and questions in the minds of learners

with scientific knowledge of the natural world to help people form memorable connections with the narratives of the dioramas (Fig. 3.1). For the viewer, this can spark a cathartic combination of scientific observation and feelings of wonderment and connection to this special and specific place.

The course introduces teachers to use museum-developed resources to supplement their teaching strategies and knowledge of content. For example, the Educator's Guides (American Museum of Natural History 2012b) are available online and in print. In the course, teachers use them after they have developed some of their own personal connections and ideas for using the exhibition with newcomers. By the time they visit the museum with their students, they will have maps of the exhibit and of the various dioramas to support their visit, and eventually, their projects. Each Educator Guide is organized around essential questions that can be explored in the exhibit. Some examples are, "Who are, and who were, North American Mammals? How does geography affect the continent's mammal diversity? How do mammals adapt to these environments?" Guides also include visuals of some dioramas, a list of 43 depicted species and their habitats, relevant glossary, maps of North American regions, additional online resources, as well as lesson suggestions for pre, during, and post visits. In essence, long-term and interdisciplinary projects are supported with these resources. There are two additional types of online resources that are part of the course of study. Documentaries on dioramas (Thirteen 2013, "Treasures of North America"), and Science Bulletins – a collection of short videos and visualizations designed to introduce the public to the work of scientist all around the world. For example, Yellowstone National Park is depicted in one of the dioramas and additional information is provided online. At the end of the course, we find that one teacher's student has specifically included this resource in their project (American Museum of Natural History 2012a).

3.2 "The Story": A Qualitative Narrative of Observations and Conversations

During the third session of the course, after teachers have done some readings on how we learn in museums, we invite them to do an open-ended walk through the Hall of North American Mammals. Their only guide or directive is to explore one question: "How or why may you use this exhibit with newcomers enrolled in Earth Science courses?" Instructors explain that while teachers are doing the observations and talking amongst themselves, the instructors will be taking notes of conversations to use in the planning focus group later in the course.

Typically, there are between 12 and 18 teachers and two instructors. The classes meet on Saturdays in fall or spring semesters. Each session is 5 h long for a total of six sessions – totaling 30 instructional hours. As we all walk to the exhibit and pass the bronze statue of Theodore Roosevelt, some stop to take pictures of themselves near the sculpture. Then we enter the Hall of North American Mammals. There seems to be some tension regarding the task and question. Firstly, the question does not mention mammals at all, and secondly, these teachers don't teach biology. At times they look confused or maybe a bit uncomfortable or unsure of how these dioramas will support their teaching of the Earth science curriculum.

This is a story from a particular Saturday in 2013. It begins with a teacher commenting impatiently, *"Why are we looking at these mammals? I teach kids from all over the world and I need to focus on Earth science concepts and content related to the Earth Science exams in this country."*

Others comment on the possible misuse of instructional time*, "My new immigrant city kids will never see these animals or landscapes."* Or, *"This would make sense if I was teaching social studies"*.

We respond casually with a comment, "*Today let's just observe the landscapes and begin to think about how regions may or may not be familiar to our students, or to us. Let's think of places we have been to or would like to go."*

These comments shift the focus from what we call a "deficit approach", which we witness in comments such as, "*my kids will never see these animals*" to original question of how may they use it with newcomers?

When she sees the diorama in Alaska, Laila wonders aloud without addressing anyone in particular, *"I would love to go to the Pacific Northwest coast. Look at these puffy white clouds. What a beautiful skyline, and so many small islands"*. Someone picks up on Laila's observations of beauty in nature and adds her own wonderings, *"Who makes these dioramas? Are they scientists or landscape painters?"* Another teacher says, "*Why do these dioramas seem to go so deep into the distance?"* Then someone calls the group over to the diorama of the Grand Canyon and says, *"I wonder how they painted the Grand Canyon so well. I was there when I was in college and it looks just like this diorama"*. In hearing these comments, we take note. We do not always comment, instead letting them share with each other. Later, in the focus group, we will surface these conversations to try to find unifying themes to aid in developing lessons or experiences for their students.

During the walk, we hear three different comments that provide us with the opportunity for further study into how dioramas help us reveal teachers' own prior knowledge and nascent knowledge of their students. *"Look at this armadillo, I bet some of my Mexican students will recognize it."*

Then three others continue this line of thinking, "*I bet you [that] my kids have seen squirrels in the park… but flying squirrels? I doubt it*." "*And look at these horns; I also noticed the horns in the hall of African Mammals. Are they horns or antlers?"*

A teacher asks, *"Are these animals real or stuffed? I think that I would love to have the time to teach kids how to make dioramas. My daughter made one in her private school using shoe boxes."*

The final teacher observation we record this afternoon gives us insight into how dioramas help them be reflective *"You know, I have never been to many of these places, I will have to sharpen up my own knowledge and get a good map of North America."* Someone else comments, "*Yes, maps and globes. I notice that some of my students love maps and are always trying to find their homelands on the classroom globes and world maps. Maybe they can teach me, and together we can list and extend each other's knowledge of places we know and places we want to know."*

3.3 Focus Group to Identify Themes from the Conversations

During the last hour of the day, we form a focus group. We use this methodology of qualitative research to look closely at the conversations to identify and create themes and categories (Fig. 3.2). These categories will serve to develop essential questions to plan museum trips, inspire projects, do web searches, and eventually, present their students' projects on North America at the end of the semester 2 months later. The value and research on conversations in museums (Leinhardt and Knutson 2004) has been a rich source of revelations about what we know, what we wonder about, and what we learn in the company of others while walking through exhibitions.

In our story, we found four themes that cut across areas of teacher knowledge. The first theme is areas of personal knowledge, such as places they have been to and others where they would like to go to in North America. A second theme focuses on artistic or aesthetic dimensions at the emotional or skills level: they note beautiful clouds, what type of professional makes these dioramas, how they are made so similar to the actual places. There are questions about the art of taxidermy or about the painting perspectives that make the dioramas look so deep into the distance. There are two additional themes: their students and curriculum planning. Under students we note the armadillo and the student from Mexico, and potential interests in globes and world maps. In curriculum planning we list: students teaching their teachers about places familiar to them or origin, reciprocal learning together about places in North America, teaching students how to make dioramas, and even learning about similarities and comparisons between North American and mammals in other continents. They now take notes. Work in small groups and agree on a variety of

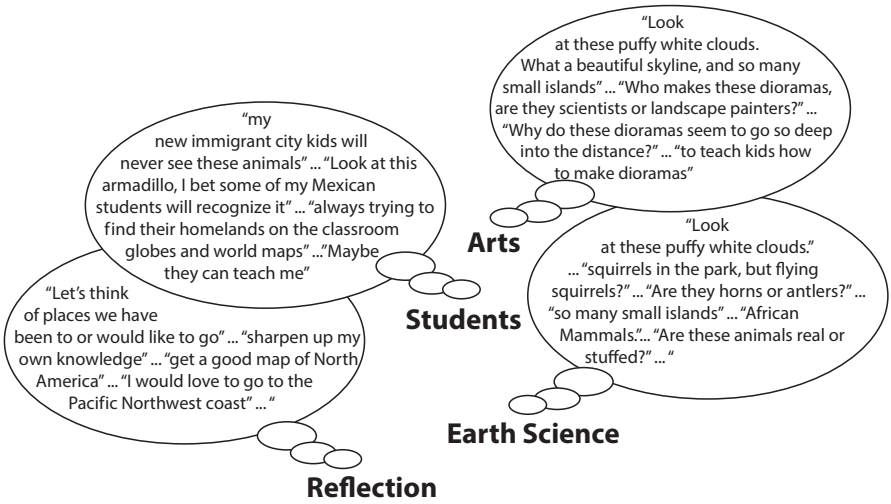

Fig. 3.2 In categorizing the of statements by participants we see overlap between our realms of the arts, students, reflection and science

projects and lessons related to the required visit to the museum. They decide to call their projects, "Expeditions to North America".

These combined methodologies of observations, conversations, objects, questions, and description are at the core of evaluation and research on learning science in informal environments (NRC 2009). In our case, the conversations resulted from open-ended questions and, in the focus group, we identified the themes that will guide their assignments. They will develop essential questions, visit the exhibitions with their students, develop plans for a 2 week project, and present these projects at the end of the semester. Another important linchpin to our findings about art and aesthetics reiterate Maxine Greene perspectives, "Aesthetic experiences are memorable for the sensory, affective, and enjoyable encounters they engender" (Greene 1978).

For instance, in the Wapiti diorama in the Hall of North American Mammals, a bull elk is bellowing into the gloaming dusk. The painted background – a faint pink sky and an emerging moon – captures ephemeral moments in time. In reality, this particular time of day lasts for only 15 min. When our students engage with the dioramas using an aesthetic lens, other realities emerge through open-ended questioning, such as "What do you see happening here? What makes you say that?" We ask the students to use evidence by 'reading' the details of the diorama. We can also ask newcomers, "What does this make you think of based on what you know about North American environments?" And, "Are there any connections to your homelands?" Such lines of questioning allow for a great diversity of responses that support many points of view. You don't have to be an expert to share the knowledge derived from personal experience.

Holmes, our co-author, is known for his visits to locations depicted in dioramas (Fig. 3.3). "You know, I have the same response to those scenes, I want to go visit

Fig. 3.3 The actual Timberline Diorama site at Logan Pass, Glacier National Park in 2007. The fact that the dioramas are of actual places allows us to bring in resources like topographical maps and considerations of human use and topics like climate change and the change of habitats. (Photo by Jay Holmes)

these places and explore them. I have managed to find several, you have this wonderful "déjà vu" experience, seeing the same mountains, plants, rocks and sometimes the animals and always new things to observe." Many of the dioramas represent parts of national parks and monuments, like the Mule Deer Diorama from the Devils Tower National Monument. The diorama includes some beautiful cirrus clouds, a river and the towering remnant of a laccolith. These are great elements for teaching about the water cycle, weathering and geology.

3.4 End of Semester Teacher Projects

At the end of the semester, teachers report on their work using the exhibit with newcomer students and how they developed projects. All teachers must report on his or her assignment to use the museum to teach newcomers about North America. They have called the projects "Expeditions to North America" and projects can be organized around questions in their own classrooms. The reports consist of three parts: (a) a the central focus or essential questions of their projects, (b) a PowerPoint that shows students at the museum doing observations; and (c) descriptions of projects that reveal interests in aesthetics, geography, and sciences. It is important to say that although their newcomer students may speak of a variety of languages, their instruction at the museum is done in English. At the museum, concept teaching depends heavily on their teacher's guidance and facilitation, the essential questions, the power of exhibitions at the aesthetic, scientific and geographic dimensions.

The nature of the projects and reports show that teachers have made use of various museum-developed resources beyond their visit to the museum. Using the term "expeditions" seemed to spark a variety of topics and interests related to expeditions. For example, some were interested in an expedition to Yellowstone following the reading of an assigned article entitled, "Yellowstone National Park is a Volcano", and scientists at work on "Yellowstone: Monitoring the Fire Below", the related

Science Bulletin on the subject of National Parks and volcanoes (American Museum of Natural History 2012c).

In the following three essential questions for "Expeditions to North America" projects we find some of the themes that emerged from their own students:

> Where do my favorite mammals live in North America?
> Why are there National Parks in North America and how many are near NYC?
> Are there similarities or differences between landforms in North America and other places we know?

There are other projects that are directly connected to the initial observation (Fig. 3.4). The teacher with the comment on the diorama shoe box that her daughter made in school was able to offer that experience to her newcomers. Her challenge was securing the materials. She got to see how creative students were in recreating the dioramas. They exhibited them in the school and showed a narrated introduction to families on family night. They recorded it on video and families asked for copies to send to extended family back home.

A focus question put forth by another teacher was, "*Where else would I like to go in North America and how would I travel there?*"

Some of the places students selected to research and visit were:

- Alaska
- to where the Bison roam
- to the tallest mountain
- to the mouth of the longest river in North America

Fig. 3.4 Student diorama by Ethan Glover Bailey depicting a Harpy Eagle with prey

These diorama-based research questions took about 2 weeks to research. The students then combined their research and designed a travel plan that included itineraries, factoring in travel time, and calculated costs for both air travel and AMTRAK train.

One of the most interdisciplinary projects was "*The Travel Agency"* in an eighth-grade classroom. The question posed was, "*Where would you like to travel around the world?*" Each student or small group of students was to identify a place they would like to visit and create a tour brochure. The PowerPoint showed the students at the museum. They were in the Hall of North American Mammals and also in the Hall of Mexico and Central America because there were several students from those regions. Other pictures showed the classroom arranged as a travel agency. The classroom was filled with samples of commercial brochures for Eco-Tours to many places. One of them was to Costa Rica to save baby turtles. Others focused on the cloud forests and butterflies. There were students from Costa Rica in his class, so the interest was high. They developed a bilingual brochure in English and Spanish. At one point, when discussing that Mexico had volcanic rock because there were many volcanoes in that area, one of the students from Africa commented*, I think Kilimanjaro is also a volcano*. As a result, this teacher hoped to expand the project – the development of a travel agency – to include tours to their homelands. However, since most of the students are in the United States because of political unrest and other trying conditions in their home countries, he decided not to take that direction unless it was suggested by the students themselves.

When he finished his presentation, several classmates (teachers) taking the course, asked him where he would like to travel with students. He answered without hesitation, "To Tortuguero in Costa Rica to help rescue the baby turtles from predators. I want my students and I to experience caring for an endangered species that we can hold in our hands and walk to the water for [the turtles'] first swim." This is an excellent example of how the students and their interests influenced their teacher. Their teacher had also expanded his use of the museum to include the Hall of Mexico and Central America to learn from his students what they would share from their places of origin. At some point in the course, we mentioned the idea of using a science hall and a cultural hall on the same trip whenever it seemed appropriate; and he had taken advantage of the idea based on his interest in the students' places of origin. Only in a natural history museum with science and cultural exhibits could this interdisciplinary expedition take place.

In summary, our interpretation of this story is that it depicts an example of place-based learning. We know that through the lens of place-based education, (Gruenewald 2008) people can become intensely engaged in a place they know intimately or the one they are viewing in a diorama. Such immersive interactions can, "…become a conversation about personal geography and our relationship to our island home, the homes we had left, and the homes we hoped to find" (Graham 2008). This journey with dioramas can provide a foundation for integrated teaching. Gruenewald (2008) states that, "A focus on the lived experience of place puts culture in context, demonstrates the interconnection of culture and environment, and provides a locally relevant pathway for multidisciplinary inquiry." For these reasons, we believe that this

course has evolved from the teachers as they work with the pedagogical framework of the course. Now, we will end the chapter by describing why we do this work: To welcome the Newcomer Students we meet in schools, such as the Newcomers High School in New York City, to the Hall of North American Mammals.

3.5 Newcomer Students: A School Profile

When we consider the reality of newcomer students to fulfill our institutional mission, we seek inspiration based on the needs of these students. One of these inspirational schools is the NYC Newcomers High School, located in the borough of Queens. In a recent visit in January 2016 with the school principal, Mr. O. Sarmiento, we learned that there are 50 countries represented and 31 languages.

The languages and origins of the students include Arabic, Bengali, Bosnian, Haitian Creole, and Hungarian; Indonesian, Korean, Malay, Greek, French, Spanish, Chinese, Nepalese, Urdu, Uzbek, Serbo-Croatian, and 15 others. One of our goals with the teachers of new immigrant students is to create learning experiences that they can replicate with their students. Students attending this school cannot have been in the country for more than 1 year. Their in-school curriculum includes instruction in native languages, followed by transition to bilingual classes, and then to English immersion.

In addition, the school has a strong arts department because while students are learning English they can express themselves and their knowledge through art. Paintings, drawings, sculpture, and photography adorn the hallways and offices. There are also organized expeditions to surrounding states to expand their urban experiences. More than 75% of its students achieve highly enough to enter college at the end of their high school years at Newcomers.

3.6 Conclusion

As teacher educators, the authors believe that we need more case studies of museum pedagogy for specific populations of students. These case studies or descriptive stories that reveal how teachers learn in museums, prior to teaching their students in museums, will be valuable. In summary, the salient themes for us continue to be teacher personal knowledge, pedagogical knowledge, perspectives on place-based learning, essential questions, and the three dimensional experiences with aesthetics, science or cultural content, and geographical knowledge when addressing the needs of newcomers.

3.7 Remembering Roberta Altman (1947–2017)

In memory of our dear friend Roberta Altman (1947–2017; Professor at Bank Street College of Education), a transformative educator who motivated all of us with her humanity and passion for life, arts, and museums. She was well known for her love to teach with dioramas and exhibits, which inspired her colleagues and students at museums, schools, and around the world.

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Dr. Maritza Macdonald is currently Senior Director of Education and Policy, and Co-director of the Masters in Arts in Teaching graduate degree program at the American Museum of Natural History, the first of its kind in the United States. During her 17 year tenure at AMNH, Macdonald has focused on teaching, research on the role of the museum in teacher education; partnerships with schools, universities, and museums – both in the US and overseas and being the Principal Investigator on a variety of National Science Foundation grants. Her international activities have brought her to multiple experiences in countries where social struggles have taken place. Through

these experiences she has developed her professional concerns between education and immigrant ion, peace education, and the role of museums in the preservation of heritage. These experiences include consultation with the Vietnam Museum of Ethnology in Hanoi, the National Research Foundation of South Africa, University of Amazonia in Colombia, and Ankara University in Turkey. Prior to joining the Museum Macdonald served as researcher and faculty on Teacher Knowledge for Urban Education, at Columbia University, Teachers College, where she still holds an adjunct faculty position.

Roberta Altman (1947–2017) was a professor and advisor in the Museum Education Program at Bank Street College of Education. She was also co-teacher in the Higher Education Programs at the American Museum of Natural History in New York City. Her particular interests included: Arts and aesthetics, Place Based Learning, Cross-cultural understanding, Developmental learning, Equity in education, and Global issues in education. Roberta was the recipient of the Niemeyer Chair Award from Bank Street College in recognition of her work serving underserved and marginalized children and families in New York City and in many cities in India where she served for 3 years in the Peace Corps. She had been an educator for 48 years teaching both children and adults.

Jay Holmes is currently the Senior Coordinator of Urban Advantage Professional Development at the American Museum of Natural History. Urban Advantage is a partnership between the Museum and 7 other science rich cultural institutions in New York City. UA helps teachers bring student centered science research to over 80,000 New York City middle school students. Jay designs and delivers professional development to teachers in areas of geology, ecology, evolution and genetics often incorporating the AMNH dioramas. Mr. Holmes joined the American Museum in 1992 as a lecturer for the special exhibit “Global Warming: Understanding the Forecast.” Since then he has been Coordinator of the Museum’s After School Program for high school students, and advisor for the Museum’s ecology club for teens, developed and implemented hands on activities for visitors in the Museum’s Discovery Room before joining the UA team in 2004.

Chapter 4
Window to Nature: MuseobilBOX-Dioramas in the Museum Koenig

Eva Neitscher and Hae-Yon Weon-Kettenhofen

4.1 An Investment for the Future

Dioramas are one of the main focus points at the Museum Koenig. Alexander Koenig, the founder of the museum, had dioramas built based on pictures he took on his many explorations. Visitors to the museum have been able to see these exhibits since the early twentieth century.

As a standard attraction in natural history museums, dioramas present a window to the natural world. They show the relevant ecological contexts: interactions between both individuals of the same species and those of different species, their environments and innate nature.

Dioramas are an important part of the museum experience as they encourage visitors to discuss what they see. They create specific moods and emotions (Mothes 2013). In this way, dioramas create an environment in which the visitor is no longer a passive viewer, but an active participant, stimulated to not only think about the exhibition's content, but also to ask questions about it. For this reason, dioramas are a highly suitable means of introducing children to the work of a natural history museum. Carefully designed dioramas provide the perfect environment for successful teaching; they offer different points of reference for teachers to explain the scientific contexts (Scheersoi 2009).

Passing on knowledge about and enthusiasm for nature are two of the main aims of the Museum Koenig. The MuseobilBOX-project combines these aims and the learning method "diorama" with another important concern of the museum's education department: the engagement of children from educationally disadvantaged backgrounds.

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One third of German children grow up with limited educational opportunities (Autorengruppe Bildungsberichterstattung 2014), but education is essential; it enables children to orient themselves in the world, to understand it and to take an active part in its continuing development, whilst gaining the abilities to develop strong personalities and lead autonomous lives. Indeed, providing education is the most important investment in the future that can be made. Unfortunately, educational success still depends too much on social background; children from disadvantaged backgrounds, through no fault of their own, are often lacking in commitment, persistence and stamina. For this reason, it can be more difficult for these children to enter the workplace successfully later on. Every child deserves the possibility of a good education.

The aim of the MuseobilBOX-project is to inspire in these educationally disadvantaged children a lifelong interest in museums, which are one of the most important places for extracurricular cultural education. Through their experiences, the children discover that a museum is an exciting and fun place to learn – not only for the duration of the project, but also in the future: A place to come back to.

As described above, dioramas provide an excellent tool with which to achieve these aims. To quote the motto of the Museum Koenig: "Our blue planet – The living network", the dioramas reveal the interactions and connections of life itself. In the same way that animals interact with their environments, children interact with their own surroundings. Moreover, they are integrated into a network of families, friends, schools, sports teams or music groups. This commonality appeals to children in an emotional way, thus giving them a way to express themselves and develop enthusiasm for their environment.

The goal is to make the world of museums accessible to these children and help to improve educational equality. A museum is not only a place of extracurricular learning, it also offers a multidisciplinary platform for education. Here, children are taught by people from a variety of different backgrounds, who occupy a number of different roles: from volunteers, interns and taxidermists to museum educators, art educators, qualified teachers and scientists. All these people help developing the following different competences in the children:

- Museum competences: specific museum-oriented tasks and duties, working methods, the exhibits themselves, the work behind the scenes
- Process-related competences: how to get to and from the museum, how to behave, how to find their way around the museum
- Comprehension competences: to notice, to communicate, to analyse, to structure, to present, to transfer and to adapt

The initial goal for these children is not to become experts in museums, biology or the arts. They are meant to experience teamwork, pursue aims, increase perseverance, strengthen frustration tolerance and learning. Considering the invested effort and the employed methods, it can be argued that these aims can be achieved through this project: The project strengthens the children's trust in their own abilities, talents

and skills. They learn to value themselves, others and other cultures, whilst learning in an enjoyable and accessible way that each of these things is unique. Cultural education is the key to creating a pleasant, tolerant and communicative society, which is one with itself and its environment.

4.2 Out of Sight, Out of Mind?

Working together with local partner institutes, the project's developers wanted to ensure that a long-lasting educational effect is achieved. Hence, an alliance between the Alexander-Koenig-Gesellschaft, the primary school Paulusschule and the Offene Ganztagsschule "An der Düne" (OGS, afternoon supervision) in Bonn Tannenbusch was formed at the Zoological Research Museum Alexander Koenig. The OGS takes care of children who live in the city districts of Neu-Tannenbusch, Alt-Tannenbusch and Dransdorf, which are underprivileged and deprived districts of Bonn.

70% of the children attending the OGS "An der Düne" come from migrant families and 30% live in a one-parent-household (Bundesstadt Bonn, Statistikstelle). This often leads to educational disadvantages for the children; many parents don't speak German and do not know about the cultural opportunities their city offers. They often have to work and therefore cannot spend a lot of time on extracurricular activities with their children. In addition, visiting places of cultural education is often a financial burden these families cannot afford. Therefore, it is difficult for these children to enjoy the same educational opportunities that better-off families can take for granted.

This project offered these disadvantaged children an opportunity to get to know a local cultural place through multiple visits, which are free of charge during the time they would normally spend at the OGS "An der Düne". The aim was to motivate them to visit museums themselves, to teach them how to get there and what they need for a visit. Moreover, the project was meant to illustrate that museums can be fun and exciting, as well as informative.

After learning about the museum and its role, the children considered the question, "Which things from my life should be preserved and presented in a museum for people in the future to see?"

This task was deliberately chosen for the project in order to combine the children's social environment with aspects of nature they can experience at the museum, and those aspects they already know or get to know during their time at the Museum Koenig. After all, it is well known that Alexander Koenig himself preserved what was important to him and presented it through his dioramas. Therefore, The MuseobilBOX is intended to connect the traditional and modern presentation form of the diorama with the children's big city lifestyle, with the goal to make the museum a more accessible and even "normal" part of children's lives.

4.3 The MuseobilBOX

The MuseobilBOX is 60 cm × 40 cm × 40 cm (Fig. 4.1) and is made out of thick white cardboard. There is a window in the front panel through which visitors can see into the box. The front panel can be removed, making it possible to fill the box with landscapes, animals or plants. Once the panel is back in place, the diorama is finished and ready to be exhibited. The exterior of the box can also be decorated.

4.3.1 Getting Started

During the four courses that ran in 2015, 42 children from the OGS "An der Düne", aged seven to eleven, attended the MuseobilBOX-project at the Museum Koenig. Ten were in the second year of primary school, six in the fourth year and 26 in the third year. They visited the museum for 12 afternoons over a period of 4 months and worked on their cultural, presentation, creative and communication skills. Two courses ran from March to June, while two ran from September to December.

Fig. 4.1 Empty MuseobilBOX

4.3.2 Exploring the Museum

Anyone who wants to be creative needs to collect ideas. With this in mind, the children spent the first five MuseobilBOX-days discovering the museum. Each of the days was divided into two parts. During the first part of the day the children were told something about the work of a museum. The second part was more active with riddles, handicrafts or role-plays to consolidate what they had learned earlier that day.

Day one was all about exploring the museum and how to get essential information such as admission, opening times and how to get to the museum by public transport. The children were informed about the main tasks of a museum: collection, conservation, research and teaching. They discussed questions such as which exhibits are on display, why preserved animals are in a museum, where they come from and how long they have been in the museum.

The children discovered both the museum's public areas and those behind the scenes, and eventually were able to move around quite confidently on their own. Thus, they developed the enduring skills needed to be able to explore exhibitions and museums independently.

The acquisition of all this information was encouraged through riddles about the museum, which the children had to solve during the active part of the day.

4.3.3 The Scientific Collection

On the second day, the children had their first chance to see the research areas of the museum when they visited the scientific collections and were given the opportunity to accompany the scientists and get to know their daily routines.

Impressed by the sheer number of items that the museum owns, but which cannot be shown in the exhibition cases, they explored the ornithological, mammal and entomological collections. They also discovered the meaning of "biodiversity" and why it is important.

The children were often unaware that some of the animals preserved here are already extinct and that these collections are the only means remaining by which they can be studied. Every preserved animal is carefully labelled and documented so that the scientists can do research on them. Over the course of this day, the children discovered the importance of every single original exhibit, not only for scientific reasons, but also for the general public, which otherwise may never have the chance to see these specimen.

Inspired by these remarkable discoveries, the children practiced working with different scientific tools such as microscopes, magnifiers, tweezers and pipettes. Afterwards, they examined different animals, some alive and moving such as brine shrimps, while others were dead and preserved, including butterflies and beetles. They were each given one insect in particular: the dung beetle (*Anoplotrupes stercorosus*), which was prepared for them under a magnifier. The children learned

how a scientist would draw and label such a specimen and afterwards were able to practice what they had been taught by attempting their own scientific illustrations.

4.3.4 Dioramas

The project's scientific focus was on dioramas as a way of presenting the natural world and its relationships. Most of the dioramas in the Museum Koenig show the scenes that Alexander Koenig saw and wanted to preserve: the natural surroundings of his native Mecklenburg or scenes he saw during his expeditions in Africa and the North Polar Region. These provide unique and invaluable historical evidence of the natural environment at the turn of the nineteenth and twentieth centuries.

Following Alexander Koenig's instructions, nine large dioramas were built for the museum's opening in 1934. He attached great importance to the value of taxidermy and used it extensively in his dioramas, every single one of which can still be seen in the exhibition.

These dioramas are:

- Animal life on the White Nile
- Nile lechwe in Sudan
- European elk and European bison in East Prussia
- Breeding bird colony on the Bear Island
- Wild boars in Mecklenburg
- Red deer in Blücherhof
- Shoebill in Sudan
- Animal life at Lake Baikal
- Animal life in the Caucasus

In 1904, Alexander Koenig bought the Blücherhof in Mecklenburg, where he spent most of his later years. Some of the dioramas shown in the museum are based on Koenig's experiences there, such as the "Red deer in Blücherhof" or the "Wild boars in Mecklenburg" (Hutterer and Oesl 1998). Others are based on what he saw during his many journeys to Africa and Spitsbergen (Animal life on the White Nile, Nile lechwe in Sudan, Shoebill in Sudan or breeding bird colony on Bear Island). He never visited the Caucasus or Lake Baikal. The dioramas "Animal life on Lake Baikal" and "Animal life in the Caucasus" were probably built in remembrance of his family roots and background.

Alexander Koenig and his staff members chose and collected the specific animals needed for the dioramas. If they could not collect them by themselves, they tried to acquire them from other museums. Two more dioramas, "Vulture with Carrion" and "Bearded vulture in the mountains" (Hutterer 2014) were built later, but had to be moved for the major refurbishment of the museum (Reopening in 2003). During the conversion, two impressive walk-through dioramas were built: The Savannah and The Desert. The scenes are not behind glass and the visitor can literally walk through the habitat; a unique experience which every visitor will most likely remember.

Alexander Koenig was a great aficionado of dioramas and so it was perhaps inevitable that this type of display would become a prominent part of the MuseobilBOX-project. The children examined the different dioramas, which can be seen in the Museum Koenig, but one diorama in particular was studied in great detail:

Alexander Koenig was a keen ornithologist, collecting birds' eggs and nests. As a result, one special diorama was built: The "Bear Island"-diorama. The template for this exhibit was a photograph taken by Alexander himself when he visited Bear Island (Bjørnøya) close to Spitsbergen, in the Arctic Ocean, far north of Norway. It shows a clifftop nesting site with eggs, nests and more than 90 individual birds, including seagulls, puffins, little auks and guillemots (Fig. 4.2a).

Thus, during the second part of the day, each child chose his or her own bird, gathered information about it, drew it and finally presented it to the class. Through this task the children were able to describe things in their own words, practiced their presentation skills and furthered their knowledge of European birds, some of which can be found in their own neighbourhoods (Fig. 4.2b).

4.3.5 A Taxidermist's Work

Some of the most important workers in a museum are the taxidermists. The children often asked where the animals came from, and whether they had been shot in order to be exhibited in the museum and how long they had been part of the exhibitions. To learn about the craft of taxidermy, the children spent 1 day in the taxidermists' workshop (Fig. 4.3a) and discovered how varied a taxidermist's work is.

Taxidermists are both artists and craftsmen; not only do they preserve the animals and prepare them for the exhibition, but they also build the plants, stones, rocks, branches, fruits, flowers and even the soil of the different habitats depicted. During the time they spent in the studio, the children caught a glimpse of how much work is required to produce a single realistic-looking leaf for a rainforest-diorama.

This exercise allowed the children to develop the ability to describe the things they saw in detail by using their own words. In addition, they learned to listen carefully to instructions with regard to finishing their own taxidermy work later that day. Both of these tasks improved their language competence.

The day ended with the handicraft-work. Each child was given a fire salamander made of gypsum. Further, they were provided with pictures of real fire salamanders and were shown preserved specimens, so they could work on them by themselves. Every child was permitted to colour their own salamander as they believed a taxidermist would do. Some salamanders did indeed look realistic while others were pure fantasy with pink glitter and rainbow coloured skin (Fig. 4.3b). This activity enabled the children to develop their motor and creative skills. They also learned to persevere and concentrate for a longer period of time – important skills for their future working lives.

Fig. 4.2 (**a**) Discussing questions about the "Bear Island"-diorama (**b**) Learning everything about my bird

Fig. 4.3 (**a**) Visiting the taxidermists' workshop (**b**) A fire salamander is produced

4.3.6 The Museum's History: Alexander Koenig

On the fifth day, the children learned more about Alexander Koenig's life, his special interest in biology and how he managed to build the Museum Koenig.

Alexander Koenig was born in 1858 and spent the first 10 years of his life in St. Petersburg, Russia. His father, Leopold Koenig, became a very successful sugar producer which meant that the family never lacked financial resources.

The Koenig family were ethnic Germans and, in 1868, they returned to their roots. They emigrated to Bonn in Germany and bought a villa ("Villa Koenig"), today known as "Villa Hammerschmidt", which became their new home.

Even as a boy, Alexander Koenig was fascinated by nature and took part in many outdoor activities such as fishing, hunting, and especially ornithology. He collected nearly everything he found with a clear preference for birds' nests and eggs. He even managed to convince his father to provide him with a room in the villa to store his collections (Hutterer and Oesl 1998). Therefore, it was no surprise that he eventually studied natural sciences at the universities of Greifswald, Berlin, Kiel and Marburg (Eisentraut 1973).

In 1884, he married Margarethe Westphal and they moved into a new villa across the street from Villa Koenig, which was a wedding present from his father. A few years later, Koenig built an extra wing to hold and display his zoological collection (Hutterer and Oesl 1998).

His research expeditions started only a year later. His wife frequently accompanied him and together they travelled several times to the western parts of North Africa and undertook expeditions along the River Nile. On these expeditions, Alexander Koenig and his staff monitored and collected exotic African animals, while Margarethe Koenig recorded their experiences in her diaries. Some of these diaries were published alongside Alexander Koenig's research (Eisentraut 1973).

In 1905, he travelled to Spitsbergen for the first time. Impressed by the large breeding colonies of oceanic birds, he later built the "Bear Island"-diorama which shows one of these scenes (Eisentraut 1973).

The available space for his collection quickly became too small and his desire to build a natural history museum intensified. Construction began in 1912, but the First World War started before they were able to finish the building. During the war, the museum building was used as a military hospital and afterwards as military barracks by the victorious countries (Eisentraut 1973). To make matters worse, Alexander Koenig lost his assets to inflation and, as a result, was unable to finance the building work on his own. After long and difficult negotiations, he finally transferred the ownership of the museum to the German Reich, on the condition that it would remain a natural history museum with all the work and duties it entails. The museum opened in 1934, the year of his golden wedding anniversary and the pinnacle of his life's work. He was the director of his museum until he died in 1940.

But how long ago is 100 years? This is an incredibly long period of time for a 10-year-old child to comprehend. To bring the children closer to this period of time, a visit to the "Villa Hammerschmidt" was arranged. It is located in the centre of the former West German capital Bonn and has been the official residence of the Federal President of Germany since 1950 (Hutterer and Oesl 1998). The children were very impressed by the visit during which they learned about the German government and the German constitution.

The children also learned why the Museum Koenig is of historical importance to democracy in Germany: On the first of September 1948, the official opening session of the Parliamentary Council, which approved the Basic Law for the Federal Republic of Germany, took place in the Museum Koenig. Furthermore, for a short time the seat of the first Federal Chancellor of the Federal Republic of Germany was in the Museum Koenig. Germany's first Chancellor Konrad Adenauer worked in what had been Alexander Koenig's office.

After this "political" journey, the children dressed up in costumes based on what people such as Alexander Koenig would have worn at the turn of the nineteenth and twentieth centuries. This helped them to develop historical empathy and was an overall enjoyable activity for all participants.

4.3.7 Being Creative

During the second part of the project, the children built and designed their own dioramas (Fig. 4.4: Designing the MuseobilBOXes). The aim was to transfer the essence of the big museum dioramas to the small box and to combine the children's

Fig. 4.4 Designing the MuseobilBOXes

lives with an aspect of nature. They had to think about what was important to them in their own lives and should be preserved in a museum. Some children chose a special habitat that they had seen in the museum, some chose city-scenes and others designed fantasy worlds.

An art educator taught them colour-theory, which consists of techniques for colour mixing and the handling of different materials and tools. They worked with feathers, cotton wool, sponge rubber, cardboard, pieces of wood and different types of pens and paints. The three-dimensional artwork was made from dough, cardboard, polystyrene and natural materials such as pine cones, wood-pieces, horse chestnuts and cork. This variety of material and their application increased the children's fine motor skills and their autonomous creativity. Fostering teamwork mentality was another important aim of the project. During this task, the children learned to work collaboratively and to deal equally and as a team with success and failure.

Eventually, the dioramas were finished and a huge variety of subjects could be seen; ranging from pets, which the children used to own, penguins in their natural habitat, jungles, car races through cities, life in the Stone Age compared to today, African animals, underwater worlds, to European woods and miniature museums of football or swimming.

4.4 The MuseobilBOX-Exhibition

At the end of the project, the MuseobilBOX-dioramas were presented in an exhibition, which was open to museum visitors for 3 months (Fig. 4.5).

Fig. 4.5 The opening of the exhibition

The opening of the exhibition was prepared in only 2 days. Supported by the museum's education officers, the children planned what should be part of the opening. The first task for each child was to come up with a name for their diorama. Afterwards, they were photographed as the creator, in order to label the MuseobilBOXes for the exhibition. Later on, the children working together as a team designed posters, decorated the exhibition room and arranged the catering for their guests. Most importantly, they also had to prepare short speeches. The topics of their speeches had to include the tasks and objectives of a museum, the taxidermists' work, the Savannah habitat and the process of designing the MuseobilBOXes. Almost every child delivered a speech in front of the audience, demonstrating not only how much their presentation skills had developed, but also how much their participation in the project had boosted their confidence in their own abilities.

It was anticipated from the start that it could be difficult to get all the children, and especially their parents, to attend the opening event. Therefore, it was very positive and noteworthy that during the day of the presentation, every seat had been taken and every child was present. Some children were accompanied by more than ten friends and relatives. With this high level of participation from teachers, classmates, parents, siblings and friends, the children received the well-deserved recognition for what they had achieved during the project. Every child was very excited and extremely proud. On a further note, the director of the Museum Koenig also showed his appreciation for their work by giving a welcome speech and awarding the children with their certificates.

Finally, the MuseobilBOXes were revealed to the audience. With the opening of the exhibition, the children received public acknowledgement of their hard work. This, again, strengthened their self-confidence and proved to them that all the effort had been worth it.

4.5 Conclusion

The MuseobilBox-project was an absolute success, resulting in even more children registering for the second course. Many of them were the siblings of the participants of the first course. 25 children joined the second course, which is an increase of 47% compared to the first course during spring.

By the end of the MuseobilBOX-project, the children understood the museum as a place of autonomous activity. They had increased their self-confidence, developed and built on existing skills and learned new ones such as cultural competence, media competence and presentation skills, as had been observed during the opening exhibition at the end of the project. Moreover, they had enhanced their communication skills, creative and motor skills and, by designing their boxes, their competence in autonomous decision-making (Fig. 4.6).

Fig 4.6 A real diorama compared to a MuseobilBOX-diorama

The long-term goal to incorporate the museum as a fixed component in the lives of the children from the OGS "An der Düne" and their families was significantly furthered by the success of this project; with the attendance of parents, teachers, siblings and friends at the opening of the exhibition, the word-of-mouth advertising for cultural institutions, such as museums, spread significantly. This will most likely continue and open doors for new and enriching possibilities for children from disadvantaged backgrounds.

One child found exactly the right words to describe what they had done during the last few weeks. Daniel, 10, acknowledged during the opening of the exhibition: "Es entstanden wahre Welten." ("Whole new worlds arose"). Obviously, the project has been one more step towards a world where educational disadvantage is a thing of the past.

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Chapter 5
Rethinking Natural History Dioramas: Bundling the Needs of Neuro-Diverse and Neuro-Typical Visitors

Paul Gabriel

5.1 Introduction

Dioramas have come and gone in fashion. They have been celebrated, wreathed in the happy glow of nostalgia and pitilessly denounced as direct purveyors of the Disneyfication of museums or as perpetuators of pernicious racist, sexist, and colonial stereotypes. Yet, like the animals they embalm and enshrine, they refuse to die.

Recent expansive reviews of visitor studies have determined that dioramas—especially when updated in the vein of the Oakland Museum of California's pioneering renovation of its dioramas in the 1970s—consistently attract visitors at 2–3 times the rate of other types of exhibits in natural science museums (Gyllenhaal et al. 2013). The public holds an "overwhelmingly positive" view of them; only dinosaurs exert more pull. Visitors respond to the size, the stories, the color and sights and sounds, the interactivity, the memories evoked and the imaginings provoked. They experience awe and wonder, refreshment and contemplation, and intensified sharing of experiences and thoughts between family and friends (Schwarzer and Sutton 2010).

But why? Especially with newer, improved dioramas, the above research points to higher engagement being correlated with targeted interactivity and multi-sensory elements (sound, touch and smell), carefully considered light and color, and judicious placement and writing of labels—all of which together seem to fully animate both the visitors and the displays.

While powerful, these findings are descriptive in their essence, summarizing the outcome of a black box of visitor experience. What if it were possible to peer inside the black box, to gain a more explanatory insight of how and why such a wide range of visitors are attracted to this exhibit type?

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This article will consider persons with cognitive vulnerabilities as expert guides in looking at how dioramas, especially in their updated forms, may be accommodating and sheltering basic processing capacities we all of share and that come under strain in sensory rich, novel environments such as museum exhibitions—navigating between oral and written language, sustaining focus and attention, constructing symbolic, physical and social way finding, and coping with sensory (over)stimulation and sensory integration.

Despite our almost infinite multitude of differences, all of us share one commonality—our brain, which in its basic structure and function overwhelmingly links us. The brain of a person with Autism, for example, is 95% similar to that of a neurotypical (Grandin and Panek 2013). This idea that we are a continuous range of diversity, as opposed to categorical sets of deviant or disordered outliers ("thems") essentially differentiated from a standard norm ("us"), is called neurodiversity.

> The lessons we have learned about biodiversity and cultural and racial diversity need to be applied to the human brain. *We need a new field of neurodiversity* that regards human brains as the biological entities that they are and appreciates the vast natural differences that exist form one brain to another regarding sociability, learning, attention, mood, and other important mental functions. Instead of pretending that there is hidden away in a vault somewhere a perfectly "normal" brain to which all other brains must be compared…, we need to admit that there is no standard brain, just as there is no standard flower, or standard cultural or racial group, and that, in fact, *diversity among brains is just as wonderfully enriching as biodiversity and diversity among cultures and races* (Armstrong 2010).

Neurodiversity has value because it allows us to see all of our brain's basic processing capacities as existing on a continuum, accounting for both our individual differences and our shared humanity. Throughout our lifetimes, all of us will undergo some kind of "disabling" vulnerability in one or more of our processing capacities, just as some of us due to injury, sickness, or aging will experience types of physical disability Armstrong (2010). notes that according to the National Institute of Health, "more than one-quarter of all adults suffer from a diagnosable mental disorder in any given year" and that other psychiatric authorities indicate "approximately half of all Americans may suffer from mental illness at some point during their lives." As we all can recognize, these times of being bumped out of the comforting illusion of normality provide very heightened senses of how environments do or do not accommodate all us in certain ways.

From this view of neurodiversity, persons who have to deal with basic cognitive vulnerabilities on a regular basis, or for a lifetime—for whom these vulnerabilities are more intense, frequent, and pervasive than for most other people most of the time—do bear their own unique burdens, but they also occupy the unique role of alerting us to some basic aspect of how our brain is configured. They may act as advance guards for understanding how things tick internally—perspicacious identifiers of what can fatigue and break down our higher cognition, our capacity for free-choice learning, our ability for flow and engagement. They strip back the lulling years of accumulated second nature enabling certain brain functions, and remind us that each had to be learned (Ramachandran 2011). Something acquired is something that can be lost, and not to be taken for granted.

Temple Grandin remarks that it is tempting to look from the outside at how people attempt to handle basic processing challenges and fall into creating taxonomies of different types, since we are in some real way all different in how we handle these challenges. But as she incisively observes—speaking of how autistic persons can be separately classified and treated, depending on whether they present with sensory over responsiveness or under responsiveness—seen from the inside both persons exhibit "two reactions [that] have the same cause: sensory overload. *Too much information*" (Grandin and Panek 2013). In other words, we all deal with the same basic challenges in our own individual ways. If that is the case, then a more effective approach is to address those core challenges and the basic vulnerabilities they can create for us *on the inside* than it is *on the outside* constantly to parse ourselves into more refined categories or to feel helpless before their daunting, almost infinite complexity.

In particular, this article will focus on three groups who appear to have much to contribute to understanding about how our brains handle museum exhibitions, and in this case dioramas: dyslexics (who mark out the extraordinary transition from oral to written language), persons with ADHD (who mark out the extraordinary executive function of our pre-frontal cortex, and its fragility), and persons with ASD, Autism Spectrum Disorder (who mark out the extraordinary way our intensely social nature impacts our spatial, physical and symbolic way finding). Persons with ADHD and ASD also mark out how our ability to handle sensory input and integrate it is an ongoing challenge we navigate for better or worse throughout the course of a day and the course of a lifetime. While according to best present estimates dyslexia accounts for up to 5%, ADHD up to 11% and ASD up to 2% of the overall population, taken together the persons with these traits make up at least 15%—if not more—of all of us. These conditions do not correlate with intelligence, being distributed across the whole spectrum of who we are, including some of our most successful, innovative and brilliant members (Center for Disease Control and Prevention 2015; International Dyslexia Association 2016; Autism Help 2016; Children and Adults with ADHD (CHADD) 2016; Autism speaks 2016).

Thinking again of a continuum model, I suggest that we regard these labels not as delineating discrete groups but rather as flagging extreme ends of a general processing spectrum we all share—only those "ends" are randomly distributed throughout all of our visitors on any given day. For example, though at the most 5% of us will have a clearly pronounced enough brain difference to be medically diagnosed as dyslexic, up to 20% of the general population manifest clear dyslexic-like behavior in acquiring reading and writing, and directly benefit from instructional methods developed for dyslexic learners (International Dyslexia Association 2016). And as we attempt to open our doors to a very diverse public, how many of our visitors may have limited formal English training for a variety of reasons, and even among high functioning readers, how many of those find that they tire over time and read less and less in the course of a museum visit? Though only 3–5% of us may struggle daily with intense issues of attention, focus and impulse control, our pre-frontal cortex that enables self-control and focus does not fully mature in all of us until our mid 20s and can degrade as we enter our elder years, as the hard result of a tiring

day, or from the stress and strain of managing a museum visit with family and friends (Klingberg 2009). And though 2% of us will present overtly as autistic, how many of us continue to deal with issues of social awkwardness, shyness, spatial orientation, fathoming metaphor and symbol, and finding sounds too loud, crowds too pressing, and sights too many?

All of these considerations lead to a pointed question—should our models of visitors implicitly be based on them humming along at above average or even 100% capacity of basic cognitive functions, or as varied, jumbled, imperfect creatures who often have bad days filled with moments of anxiety and distraction, but also glorious days of brilliance, riotous fun, and otherworldly presence? As the dictum cautions: plan for the worst and hope for the best. While we pray our visitors will attain flow and have lifetime memories take root, we must assume that they need to be sheltered and supported before they can even have a *normal* go at it.

And the *it* in this present case are dioramas. Their sometimes perplexingly resilient wide-ranging popularity argues for their enjoying a higher-than-average capacity to accommodate a larger-than-average range of the continuum of how our visitors' brains function. So to delve into how dioramas can support—or at times overwhelm or turn off—persons with basic processing vulnerabilities is to delve into how and why these particular types of exhibits mesh or don't mesh with basic needs of all our brains.

The point of access will be a case study, a 2006 summative evaluation of the "Fossil Mysteries" permanent exhibition at the San Diego Natural History Museum conducted by reviewers with dyslexia and/or ADHD. Their insights will be complemented and deepened by persons on the Autism spectrum responding to museums and dioramas. Schwarzer and Sutton (2010) remind us that there is no singular definition for dioramas, and as such they comprise "complex exhibitions that exist in many forms." To attempt to capture this diversity, I will first look at how the reviewers responded to two dioramas within the larger exhibition: an open, noisy, highly interactive area and a much more quiet, enclosed area.

5.2 Case Study: Summative Evaluation of "Fossil Mysteries" Employing ADHD/Dyslexic Reviewers

Purpose The evaluation addressed two key questions:

1. *How does the exhibit environment or specific elements within it promote or inhibit visitors' ability to focus and engage? (attention deficit evaluators)*
2. *How does the exhibition text and context promote or inhibit visitors' ability to make meaning from the presentation? (attention deficit and dyslexic evaluators)*

Method Participants for the two groups of ADHD/dyslexic teens and adults (12 total) were screened to assure that they qualified as meta-cognitive self-advocates. *Meta-cognitive* means they had full awareness of their learning difference; *self-advocates* means they had been trained by specialists to take responsibility for the

effects of that difference, which includes identifying those environments that might disable them and speaking up for reasonable accommodations. This request attempted to address Hein's (1998) lament about the vagueness of visitor interviews by shifting the focus of query from what was learned to how and why the space did or did not support the reviewers' ability to learn. ("… few visitor studies are harder to carry out so that useful information results…. Most visitors [can] not articulate what they [have] learned.") (See also Ramachandran 2011).

Two groups of evaluators were provided: 6 adolescents (all male, all Caucasian, ranging from 13–19, one ADHD, two dyslexic, and three with co-occurring ADHD/dyslexia); and 6 adults (four female. two male, four Caucasian, one African-American and one Latina, ranging from 22-mid sixties, five dyslexic and one ADHD). The two groups together provided a rough gender balance, and the 25% of the total that had co-occurring ADHD/dyslexia somewhat approximated the percentage for such co-occurrence found in studies, estimated around 30%. (Aaron 2004; International Dyslexia Association 2016) Also, the higher percentage of dyslexics matched the higher diagnosis rate for reading disorders among all learning disabilities (Aaron 2004). It became clear during the evaluation process that almost all of the ten dyslexics voluntarily read little if any text on a daily basis.

Review Format Each group was at the museum for approximately 3 h on August 17th, 2006, with the adult group working from 9:30 a.m. to 12:30 a.m. and the adolescent group from 2:00 p.m. to 5:00 p.m. Both groups were given a brief 10-min introduction, in which they were reminded that they were expert reviewers focusing on using their cognitive differences to evaluate how and why the exhibition space did or did not enable informal learning, with a specific focus on text/reading and getting and keeping attention.

The reviewers began on the ground floor atrium and were explicitly shown where on the second floor the exhibition was located, but were allowed to find their way upstairs on their own, to enter into the exhibition in any direction they chose, and to move through the exhibition at their own pace with no shadowing or prompting from me or museum staff. They were given a minimum of 30 min in the space; both groups spent approximately 45 min. All participants were encouraged to find one example of best/worst exhibit for reading and attention.

After finishing with the on-site evaluation, the groups were taken to a quiet conference room on the ground floor, where a 1-h audio-taped group discussion then followed. Finally, in the last 30–45 min, the evaluators were taken back upstairs to the exhibition, and on site of the specific exhibits they had critiqued—both positively and negatively—they were videotaped indicating exactly what in the environment worked with or against their cognitive vulnerability, and explaining how and why.

Findings: The Overall Positives and Negatives Both groups of reviewers found the organizing concept of the exhibition of high interest—a set of fossil mysteries to be explored and solved. They most benefited from displays that incorporated and integrated visual, auditory and kinesthetic components that helped "bring the fossils to life."

This sensory aspect of the exhibition was considered the most successful part of the exhibition. It triggered their curiosity and desire to learn, since the sights, sounds, and hands-on interactive elements helped prime their imaginations. They also felt that whenever accompanying text was clearly and simply related to these multi-sensory elements, the exhibits were easier to access and understand, which further enhanced their experience.

Two aspects of the exhibition most challenged the reviewers: (1) reading as a primary gateway to meaning, especially when that reading relied heavily on uncommon, scientific terms and/or overly abstract formats; and (2) the need for a more explicitly available symbolic pathway linking together all of the exhibition areas and the stations within exhibition areas. For example, only one reviewer out of the 12 figured out that walking through the entire exhibition was a journey through different pre-historic geological periods of where present-day San Diego is located—and that reviewer gained access to that understanding by reading.

In both cases, the reviewers felt that their desire to pursue deeper questioning and self-directed meaning-making was inhibited to varying degrees at times by their inability to easily "read" the symbolic meanings of certain parts of the space—they remained a mystery to them. However, to the degree that the exhibition avoided these pitfalls (as noted above), the reviewers were able to gain ready access to meaning, even if they read little or not at all, did not grasp the entire content of the text, or were not fully aware of all the symbolic connections in the space.

5.3 What Worked Best: The Dioramas

The best exemplars of meaningful sensory integration were the diorama in the south area of "Fossil Mysteries," which was most favored by nearly all reviewers (11 out of 12), and the diorama immediately adjacent. The reviewers labeled these areas as the Jungle Room and the Dead Dinosaur Room, respectively, and they will be referred to as such. (Their formal names are the Eocene diorama and the Extinction diorama.) In the first, visitors travel through its center, via a wide winding walkway and become immediately immersed in sights and sounds of the scene. The exhibit is quite large and tall, physically dwarfing the visitor, and bird calls and animal sounds fill the air. At stations placed next to the railings along the pathway, visitors can engage with interactive components inviting them to look more closely at the environment and discover its parts, or to think more deeply about certain aspects of it (see Fig. 5.1). The second diorama directly adjoins the first and acts as either its entry or exit point, depending on how visitors travel to the space. This diorama portrays the mass extinctions marking the end of the Jurassic period, but counterintuitively in a silent, meditative environment. The lighting is dim, save for strong uses of blue and red evoking the post-meteor crash glow in the sky, and the focus is on a dying creature symbolizing the extinction of most of animal and plant life (see Fig. 5.2).

Fig 5.1 Eocene diorama. Courtesy of San Diego Natural History Museum

Fig 5.2 Extinction diorama. Courtesy of San Diego Natural History Museum

To facilitate understanding of how these reviewers speak "from the inside" of a shared neurological continuum, each section below has two parts: (1) presenting research findings that may help to explain the core brain-based challenges at play, and (2) correlating those findings with excerpts from the facilitated group discussions evaluating "Fossil Mysteries," in which the reviewers identify how the exhibits either helped them overcome those challenges or left them feeling vulnerable. The

reviewers are identified by their initials. As facilitator, I am identified by my own, PG, and a member of the museum staff by hers, NOR.

5.4 Exploring Why Dioramas Worked Best

Getting the Big Picture in the Blink of an Eye: Accommodating the Binding Problem Both the Jungle Room and the Dead Dinosaur Room powerfully engaged the ADHD/dyslexic reviewers' attention, mostly by creating an immediate non-verbal sense of how everything in the space "fit together." This global response was determinative and spontaneous. In contrast, the reviewers tended in other parts of the exhibition toward sensory disintegration, meaning that the sights and sounds and spatial layout of a space dis-aggregated into unrelated pieces, making them literally and symbolically difficult to *comprehend* (to grab together into a whole). Sensory disintegration as a constant everyday difficulty is classified as a separate disorder, but the fact that its symptoms can overlap with those of persons with ASD and ADHD points to a core vulnerability our brain can face putting the daily stuff of life together (Ghanizadeh 2011; Manning-Shaffel 2007; Shaw 2012).

Two things are of interest here. The first is revealed in Benjamin's Libet's (2004) pioneering study, in which he discovered a half-second delay between onset of a voluntary action and the conscious perception of willing to perform that action. This startling finding has been robustly validated, with the range of the delay extending from 200 milliseconds to more than a second, depending on the task. Much speculation has since emerged about the why for this eerie lag. Most argue that it provides the brain needed time to bring its many parts operating asynchronously—sight, sound, taste, smell, touch, abstract knowledge, life experiences, memories of pain or reward or other interior feelings—into some kind of coherent conscious sense of the "reality" at hand (Carter 2002). This binding problem begins at the lowest levels of cognitive processing, and researchers are still exploring exactly how it happens for each sensory mode, for the linking of different modes together, and for the relating of all those merged sensations with emotion, higher order memory, and symbolic meaning (Carter 2002; Marcus 2008). The sheer volume of this associative cortex, along with an outsized pre-frontal cortex that attempts to manage and bind together all of these associative networks, largely contributes to the uniqueness of the human brain (Gazzaniga 2008; Lynch and Granger 2008). We are at our very core a bundler of bundling and bundled things. Libet's delay permits this process to play out in feed forward and feedback loops, so an apt analogy might be basting something together at blindingly fast speeds, while all the time tearing out stitches and starting over to match a pattern being made up as one goes along. Though as we get older and gain more experience, we just rely on off-the-shelf patterns and knock offs for everyday use.

It is no surprise then that the unity of perception is often purchased at the price of convenience or habit. The brain has a disconcerting tendency to confabulate—to

invent stories about its perceived experience that may or may not have much accuracy, just so long as the vacuum of meaning can be filled sooner than not in a way that seems plausible enough for explaining what is presently "there". The more novel and ambiguous a situation, the greater the pressure the brain feels to find some way of binding what it is experiencing. If it cannot, the result can be an easy fall back on stereotypes, a shrug of indifference, the adrenaline rush of anxiety, or a quick leap off a cliff of idiosyncratic assumptions (Buonomano 2011; Fine 2006; Schachter 2001). Clearly, museum exhibitions, with lots to see and do for any visitor but more so for first-time visitors, place demands on the brain to relentlessly bind the environment, or move on quickly if unable to do so.

Second, and complementary to the findings above, other research by Miller in the 1950s determined that the vast majority of people cannot exceed attempting to process 5–7 items at a time consciously in working memory *when those items are perceived to be unrelated*. People's ability to maintain focus fades rapidly, in direct correlation to what degree the upper limit is exceeded. This bundling limit can only be effectively sidestepped if individual elements are "chunked" together into meaningful wholes, and these new wholes in turn do not exceed the upper limit of 5–7 items (Marcus 2008). When all chunked items themselves are intuited as part of one clearly comprehensible whole or gestalt, they are even more easily held as a point of focus and can elicit feelings of pleasure and willingness to engage. That is, aiding the brain to make immediate sense of new situations makes it feel "smart" (Gazzaniga 2008).

In face of this "drive to bind," dioramas appear to facilitate most visitors' being able to glance at a space and intuit within a second how and why all of its various pieces fit together. Even more impressive is how this occurred for the larger diorama of "Fossil Mysteries." Both groups of reviewers independently and spontaneously named it the "Jungle Room"—no mean feat. Staff at SDNHM report that not only do general visitors consistently come up with the same term, but it is the common in-house term of reference for the space (Redmond-Jones 2016). This name is rooted in the more accessible oral, Germanic root of English, one which does not require formal education for mastery or reliance on the abstract scientific jargon of the exhibition to acquire. Such intuitive naming helps explain why it is so favored—its novelty and complexity made sense, just like that, the same way for pretty much everyone. It literally created good associations in them, so they liked it best.

GA: The visual, I guess. It was like being there. It was giving you the opportunity—oh, so this is what it feels to be back in those days with dinosaurs, like with birds going off, and seeing little dinosaurs and a big dinosaur behind getting ready to eat it or something like that…just giving you a good visual of what was going on back in those days.

JB: I like visual stuff. Like pictures and colors and stuff. It catches my attention, like from just looking at something, like just a bunch of words, I'll just pass on. Just like, screw it. Uhmm… and then for pictures and stuff, I'll stop by and kind of look at it. And then after looking at, like, I might…if I'm kind of interested in it and then maybe read the text or something, so…

PG: OK. Was there any particular pictures in the exhibit that were really good at getting you to stay and maybe do some reading and learning?
JB: Uhmm…like in that one jungle part, that pulled me in because it was all visual stuff. Yeah.
PG: Uh…you mean the animals inside the jungle…?
JB: Yeah, and like the trees and everything.
PG: Why is that better than just a picture?
JB: Because it's like 3-D. Because it seemed more real, because it was like right in front of you, kind of like a photograph.
PG: So, you liked the three-dimensional stuff? Did other objects pull you over besides that? Or did you like the room because it had all these objects in a setting?
JB: Yeah. The setting was kind of cool.

Sound as a Primary "Everywhere" Re-animator Ambient sound also played a key role in helping the reviewers instantaneously register the diorama area as an integrated space. Both vision and sound are distal senses, meaning they help us make sense of that part of our environment farther away from the proximal reach of our hands. (I am disregarding smell, as it did not come into play in "Fossil Mysteries"). Binding visual and auditory information in the brain faces hurdles. Light arrives at a much faster speed than sound waves, but then this discrepancy is in part offset when the chemical registry of information at the retina occurs at a much slower rate than for the mechanical transduction of sound in the inner ear. The brain allows up to about 200 ms for these two asynchronous systems to be bound, but this delay can allow for interesting confabulation effects if the objects viewed are no farther than 10 m from a person—a distance range most objects and displays inhabit for visitors moving through an exhibition area such as a diorama (Spence and Squire 2003; Zmigod and Hommel 2011).

The brain basically relies on whichever sense—sight or hearing—seems to be more reliable at that moment to make assumptions about how to put the two senses together. Attempts have been made to see if the rates at which sound and vision are registered and processed by the brain are used as some kind of faithful chronometer measuring how time is elapsing "out there." But research suggests instead that even if a sound occurs quickly before or after an object is seen close by, the brain will adjust to make the two appear simultaneous (Cha et al. 2012; Heron et al. 2004; Holcombe 2015; Mills et al. 2015; Vrooman et al. 2004). Its primary work is to disambiguate as soon as possible where sounds are coming from and to bring them into some kind of plausible coherence with sights—and not to be a nit picky timekeeper.

This elastic binding creates a passage through space and time that is relative and constantly changing, almost Einstein-like in its properties. Indeed, sound fills up the space between an object and a person, so when visitors move through such a space, they are enveloped everywhere in a moving fabric of sound—a spatial soundscape—that temporally changes relative to how they and the objects around them move through it, or how they perceive and interpret that to be occurring (Apprich 2006;

Collins and Kapalos 2014; Spinks 2013). As we all have experienced, our sense of how long it takes for things to happen can vary radically, as can our sense of how far away or near things appear to be. And we have at times been mistaken about how sight and sound align.

Emotion can and does play a large part in how this continuum can shrink or stretch, and so the kinds of sounds we hear can strongly affect our emotional reaction to what we see and set a mood and pace for it, like music in a film or television show. In this way, sound becomes a soundtrack that "confirms" a scene as scary or romantic, or that a bird is a bird, for example. In that latter capacity, sound makes a two-dimensional or still object seem "alive," since the brain intuits a sound as originating from the object closest in view most likely to have produced it. For dioramas, this soundtrack effect would mean that sounds are joined together with objects in the display, as if the objects were creating them "at that moment." As visitors approach and move through the diorama, the sound constantly moves with them, flowing and ebbing as they come near or take leave of certain objects, further reinforcing a "feeling" that these objects are alive all around them. This animating ability of sound has been consciously exploited in cinema and on-line games (Collins and Kapalos 2014; Grimshaw 2011; Jorgenson 2014). In a sense, the brain is always trying to turn ambient sound into a soundtrack of our lives; dioramas just opportunistically benefit from this neurological fact.

Of course, we can be confused, annoyed, amused, or creeped out if a soundtrack mismatches in strange, unpredictable ways, or appears too contrived or too loud. As will be talked about later in the article, sometimes sound can rub us the wrong way, and the magic of perceptual illusion is broken. One ADHD reviewer of "Fossil Mysteries" spoke of wandering into a separate display about avian life above the ocean surface, but he was not able to associate the surrounding bird sounds with the images of birds on a video or the cases holding bird skeleton pieces, all nearby. Everything was spatially too dis-aggregated for him, yet the birds sounded "real." So he made his best guess and looked up, thinking that birds from outside had gotten into the H-Vac system. Dioramas tend to hold their multi-sensory parts together much more cohesively, and thus usually come across for most visitors as grounding and reassuring in how they integrate sight and sound. Their re-created scene makes it much easier for the brain to bind our two key distal senses, bringing them to confabulated life. We may not always buy into it, but we certainly get which pieces fit with which (Spence 2011). Thinking something is corny is different than having no idea what to do with it at all.

PG: CC said she really liked the room, the ambient sound in there…

TJ: The Jungle Room

PG: …how did that ambient sound affect you? Did it… over time did it bother you?

TJ: It was more of a background sound for me. It just kinda set a mood.

….

EP: I thought it was a peaceful kind of sound. It was also wondrous, like any animal could have made those sounds, like yeah…just makes you think what kind of animals goes "Whooo!" Maybe like a wolf or something else.

GA: I really like the sounds and the stuff like that are in the jungle room, so I was thinking maybe like more sounds in different areas, you know. Like you go into a Jurassic area or where fish and sharks have ocean sounds…you know what I'm talking about?

PG: Mm hmm. Just give a person the sense of where they are.

GA: Yeah. Like right when you walk in, you're seeing, you're not really paying attention but you hear the sounds of an ocean area and you're going to see a shark and the skeleton of a fish.

PG: …do you guys feel that [sound] has the effect of a spotlight, that it helps you stay focused? That the sound kind of helps you hold onto those things in the environment?

GA: It's not really a spotlight because it's more than a spotlight because you're just looking at the spotlight, what's under the spotlight, you're not looking all around the whole room, you know? With a spotlight on an area you have to walk over instead of like…

….

CC: I liked hearing the noise. I think that and touching the animals really got my attention. Reading…it really didn't get to me. Same things, bones and like you said about the fish, it really got my attention. I wanted to know more but you know…

RG: Once you start reading…

CC: You start losing it. Everything else is OK. I liked the videos they had out there and I like the stuff you do with your hands and I really liked the noise…

PG: When you say "the noise", do you remember specifically where in the exhibition that was?

CC: In the very beginning, when you go in you can hear the birds and the different animals.

PG: Why did you like that?

CC: It just brought me closer to that. I think that's what it is. I would like to bring my child. I think she would like it. Just the noise really got me.

PG: For you, do you think the sounds had the same effect that the picture had for Vickie, that is providing a context?

CC: I think I liked sound more. The sound is what got me there to see more what was in there, so I think…um…seeing something that didn't have noise didn't really do anything for me. It just makes me feel like there is a dead animal and not alive. It's just dead.

PG: That's interesting. So, the sounds for you brought the things to life.

CC: Right and make me just want to just learn a little more about what's going on.

PG: Oh, so being able to bring that dead object or that inert—that object just sitting there—bringing it to life is what really made you interested and curious.

CC: Like that big whale…there was no sound to it. It just looked dead to me. I mean, I couldn't really read it, but I would want to hear the whale.

Color/Light as Key Focusing Tools for the Heart and Mind Visual processing takes up a much larger portion of cortical area than the other four senses (roughly 70%), and so where gaze is directed often indicates where one's focal point of concentration will be. As noted above, sound can help to provide overall orientation for one's eyes as they scan a space, making all its parts seem related and animated. Lighting and color can create further focus and mood points, announcing and priming key aspects of the space for exploration, especially if they are coordinated with sound as part of the space-time fabric the visitor's brain creates (Ings 2007; Wurtz and Kandel 2000). The Dead Dinosaur Room mentioned below by the reviewers uses blues and reds (not greens), colors favored by Virgin Airlines within the passenger cabins of its aircraft once aloft and for the night time dash of VW cars. This combination of colors tends to heighten focus, create calm, and make the transition between use of rods (black/white vision) and cones (color vision) in the retina less jarring in low light, reinforcing a sense of soothing relationship to the environment (Ings 2007; Lennie 2000; News 2016). The last point is important, since the Dead Dinosaur Room is entered either via the Jungle Room or from visitors just entering from outside the museum. In both cases, they will have been in relatively bright, noisy environments, and without proper lighting, the Dead Dinosaur Room would be experienced as too dim and dark.

This diorama focuses on the mass extinctions that marked the end of the reign of the dinosaurs. The sudden calmness and quiet of this room acts in direct physical and symbolic juxtaposition to the riotous biological richness of the Jungle Room, punctuating an abrupt and final end. And its lighting, color, sound and focus on a single dying dinosaur invite individuals into silent meditation on the great complexity of experiences and sensations offered elsewhere in the exhibition.

PG: Now, if you guys could talk to the museum staff and tell them how to change the exhibition, say we were going to redo, what would you tell them about improving it—not that it's a bad exhibit—but if they were going to take it and enhance it—make it better—what could they do to make it even better for holding attention?

EP: Make it darker.

NOR: We're talking about the whole thing and not just the jungle, right?

PG: Yes. Make it darker?

EP: Yeah, less light and more…

PG: Spotlight?

EP: Yes, spot focus.

PG: Why?

EP: Because it just feels more comfortable, like, it's like cooler, like on a hot day you come in, just looks interesting, makes it look cool…

PG: It holds your attention?
EP: Yeah, it definitely holds my attention. Like less lights coming down and more to like the exhibits…. Neon colors. Like the one circle room with the red. That's pretty sweet color. (sounds of assent)
PG: Which room is that?
DS: The Jungle…
NOR: The [inaudible] room with the dead dinosaurs…
EP: Yeah. (other people assenting) The bright red light. Like more neon colors—blues and greens.
PG: Well, is it easy in [the exhibition] sometimes to get visually distracted?
PL: Yeah.
NOR: In which space in particular?
PG: Pretty much everywhere or…?
GA: Yeah, everywhere.
JB: It's like you look at one thing and just kind of zone off and look at something else.
PG: So, what I'm wondering is if you had sound and a spot, it would keep you more on task?
PL: Yeah, you had a visual cue to stay in that spot.

Merged Physical and Symbolic Way Finding The ADHD reviewers greatly appreciated having a clear pathway in the Jungle Room that helped them maintain focus and have a sense of direction and purpose, but that also was not so constraining as to force them into a highly restricted pathway. I call this a "soft structure." As will be discussed in more depth below, recent research points to abstract and metaphoric thinking being grounded in parts of the brain that process physical, sensory experiences (Cherry 2012; Ramachandran 2011). Once someone has become habituated to a symbol or metaphor, it can be detached from this grounding, but introductions to new symbolic meanings or metaphoric associations are helped by explicitly showing how the things in front of someone are intended to mean something else (Benedek et al. 2013). Dioramas often benefit from the "soft structure" of a pathway that is both linear and exploratory, one that assists visitors in keeping a sense of focus on what's here and what's ahead and how they link, and in explicitly associating this directed walking through space and time as a narrative journey through a symbolic space and time.

TJ: I liked that exhibit [The Jungle Room] because it was the most pathed one. It was the most… it kept people moving, kept flowing, more than..so…having big room with an exhibit here and an exhibit there….You put the animals in more of a natural view which helped, and you could kinda see where they were in, where they would be in real life if it was still around…. There are ways to set up also things and sort of put them in a certain way so that it's not fully defined pathway but people with ADD, I've noticed, will pick up on subtle things like that. They'll be able to follow that pathway even if most people don't normally see it.

PG: There are a whole group of people, too, who have more a the right-brained, the non-verbal learning disorder, where they have problems with spatial orientation and the most extreme form of that, of course, is Asperger's or Autism, but that's way extreme [general murmurs of agreement]—but they really benefit from having a sense of where to go. They want to know kind of where to go [general murmur of agreement], and then you have people whose right brain is high functioning and their left brain is more dyslexic…where they are okay with the space being more open. And I think that what you're saying…what I'm hearing from all of you is kind of marriage where its there if you want it, but it's not there to the degree that if you don't want it, you feel trapped.

TJ: Yeah, you can still get out.

The Inherent Abstraction of Text: Too Far Away for a Front Door Finally, the ADHD/dyslexic reviewers clearly preferred exhibits that provided direct and explicit non-verbal context for scientific vocabulary—or for any text, for that matter. Such context includes unfamiliar key terms that are bolded and connected by arrows or other symbols to parts of the exhibit they name, and are defined in German-based vocabulary easily accessible to most any speaker of English, regardless of education level. Physical placement of the labels also helps, since direct proximity was understood intuitively to mean directly related, another binding predisposition of the brain's visual cortex (Ings 2007). The farther away a label was placed from what it referenced—either through physical distance, lack of visual connections to relevant exhibit parts, and/or more complex grammar and vocabulary—the more abstract the language became. (It is helpful to remember that at its root, the Latin-based word *ab-stract* means literally "to pull away from." Inherent to its meaning is creating physical and cognitive distance from what is being processed).

The dyslexic reviewers remind all of us that *any* text—no matter how descriptive or narrative—is by definition at the initial perceptual level purely abstract. Overcoming that hurdle implies cognitive work, since the binding of different brain areas required by reading is not natural but learned behavior. It can be practiced enough to feel like second nature, but that sense of relative ease cannot completely mask the effort required. Writing is only 5000 years old and the expectation of universal literacy in parts of the United States has only realistically been in place in the last few decades (Dehaene 2009). Prior to the Second World War, only 6% of white males, 4% of white females, and 1% of males and females of all other ethnicities attended college; today, at an historic high, about 30% of the general population has had some post-secondary schooling (Snyder 1993; Russell Sage Foundation 2016).

But the reality is that for most people most of the time, oral language remains their evolutionary comfort zone (Dehaene 2009; Wolf 2007). Such language use is informed by the complexity and depth of their various life experiences and thus is not unintelligent, but if given a choice, most people in the general population would rather look and listen and talk than read only. They flock to online videos, television, film and social media apps filled with interactive games, pictures, music, and

gossip—"sharing." Visitors like to bind themselves to what they are experiencing by taking selfies with objects on display or posting pictures and comments, so they then can later talk about the experience with others. This urge for oral communication also explains the audio-guide as the primary assistive technology in museums. Originated as an accommodation for a small minority community (the blind), its robust embrace by most visitors of all types points to how it shields a general human vulnerability—avoiding the effortful work of reading while standing up or bending over in noisy, unevenly lit, crowded areas. Docent-led groups or on-call docents in exhibit areas are popular for the same reasons.

In that regard, both the dyslexic and ADHD reviewers of "Fossil Mysteries" were not prone to expend cognitive resources on any text that appeared to demand too much work to re-contextualize—but they were quite open to attempting to engage with text that appeared fully contextualized, in terms of placement, form and content. In other words, reading demands enough binding work on its own, without requiring even more binding to place it in context. Making the brain work to get started, when it is neither primed nor willing to engage in game of puzzles or hide-and-go seek, will turn it off. Given all these constraints, a rule of thumb about text emerged from the reviewers: reading is not often relied on as an intuitive, primary orientation guide for an exhibit space. It is not a front door, but rather one of many doors in a hallway, once a visitor is "in" a space physically and mentally. It can be used as a means to access deeper meanings about what is being experienced, though others are also desired, such as audio guides, videos, and on-call docents.

JB: Kind of like what you said, when there's a bunch of stuff, I was looking at this thing with these shells and there was just a bunch of shells in this glass thing. And I just kind of looked at it and walked away…that's all it was, just a bunch of shells. And then some paragraph stuff on the bottom. And I just kind of go, "OK".

GA: I'm kind of with him, too, on that. You walk by and see a little bit miniature…

EP: That's what I was thinking…

GA: Even with big shells, you do a quick walk by. People won't really take the time to read the little print about that big [makes a gesture of smallness] next to the shell. I'm not going to read that.

PG: Let's say that this is a case, right. So here's the case and let's say this is the text panel, the text panel is next to the case, so obviously you understand these words go with that thing, but my question is were they clear about which words go with what?

PL: No. Not at all [general chorus of "no"s]

PG: So you were going to say, Joseph? We were talking about this, about you said…about connecting things, you didn't feel it was very connected.

JB: Like, in the jungle place, like they got the text and they usually have a picture of whatever it's talking about next to the text, so you just kind of look up and it would be right there.

PG: So that helped you.
JB: Yeah

….

NOR: Can I ask a question? So, I just want to get something clear. So, if you look at a panel and there's a bunch of words on it and so do you make the judgment, I'm going to read it, I'm not going to read it based on the number of words or if there are a lot of words, would you read a few sentences if that's all you want, or is it just like, nahh…

[Everyone talking over each other to say that that they agree with the very last statement of not reading at all if too long: "You don't want to get into it." "It takes too long."]

PG: Do you sometimes scan it first to see just if the words are too intimidating…

[Everyone talks at once to say no, they do not scan]

PG: Even to take a look at it, to test the waters…

[Again, everyone talks at once to say no the do not]

PG: So, you just walk away…

[A chorus of "Walk away"]

DS: And then if you get into it and the reading's difficult, then it's like, "Oh, this reading is difficult" and walk away. But you're not going to get into it if it's like….
PG: Oh, so if you walk in and the first word they use, for example, is the "the Pleistoscene" and you're like, oop!

[Everyone agreeing at once. PL: "Yes, exactly."]

GA: They should give us the key words we need to know. It would be like the word you can't get is all over it, all over the page that's talking about it, and you're sitting there going…
PG: And you don't know what it is, right?
GA: Yeah.
DS: One of the exhibits used the word "megafauna".
PL: What?
DS: It's like big land animals. If I didn't like…I don't know why I know what "flora" and "fauna" mean and if I didn't know, I'd have been like, "What does that mean?"
NOR: Did anyone just read headlines? To just kind of…
PG: To just pay attention…Yeah, how many of you paid attention to the signage, to the large signage, if you walked into the room, it tried to give you an idea?
PL: Most people just ignore that.

DS: I don't think I saw signs.
PL: I completely forgot once I got into the fossils.

5.5 Critical Thresholds: When Is It Too Much or Not Enough?

The reviewers had four main points on this topic.

Visual Overload The one reviewer of the 12 who dissented about favoring the Jungle Room found the space difficult to comprehend visually. It contained too many parts to hold together. Interestingly, he did not use sound as a binding tool.

PG: Did you guys find the ambient sound in the jungle room…[drowned out by everyone talking at once in reaction]
DS: I was not into the jungle room.
PG: You didn't like it? Why not?
DS: Too much going on. Once again, a whole bunch of little things. I wasn't really…there was no way I was going to take the time to see like everything that was going…like there was a snake and guess little animals but I really didn't look at any of it. There was too much. It would take too much effort to try to discern different things.
PG: Did the noise in there bother you?
DS: I didn't notice the noise.

Sound Overload in One Space For some others, the sound in the Jungle Room was too excessive, both in terms of sheer amount and pitch. Persons with ADHD or ASD often have lower thresholds for hearing sounds, and so have much less tolerance for higher volume and pitch, to the point that certain sound levels in the normal range can become uncomfortable or even painful (Autism Spectrum Disorders Fact Sheets 2016; Grandin and Panek 2013; Hallowell and Ratey 1995). As people age, they generally begin to experience sound impairment (Martin 2015), and some research has suggested that stress can induce acute sensitivity to sounds among women (Hasson et al. 2013). In light of this negative potential of sound, when visitors seek control over a multi-sensory environment, it is often because they need to modulate the intensity of a sense modality or adjust its speed, to better fit the binding needs of their individual brains.

ASD persons can respond to therapies that help them habituate to certain sounds and sights and smells and touch by slowing down their exposure to them and then slowly speeding that exposure up until they approach the "normal" range of a processing continuum (Morris 2009). Some therapies for dyslexia also operate around this notion of slowing down processing times for reading and then speeding them slowly up. (Stanford University news 2003) Many dyslexics listen to audiobooks that enable them to control the speed of the reading, so they can more easily bind

what they see on the page with what they hear. Museums have a great opportunity with random-access digital devices to provide visitors with audioguides that can adjust not just the volume but the speed of what they hear. Or to offer a range of ambient sounds to help people select a soundtrack that best enhances their experience of a space. Many visitors now do this already with their smart phones and ear buds.

PG: OK. So the noise was a little too dense.
PL: Yeah, yeah.
QW: The only thing that distracted me was the high pitch monkey screams. [EP makes faux monkey screams]
QW: Yes, it was distracting.

….

TJ: So I just use my ipod. That's why I carry it.
PG: Yeah, I saw you had it. And that's another question I wanted to ask you, because now a lot of the audio is digital, so you have lots and lots of channels. What would you think if the museum offered you several channels of various white noise, like the sound of the surf, or maybe the sound of birds, or classical music, you know jazz…(people beginning to break in with comments)…soft jazz, smooth jazz so that if you wanted to, you could just block out…
VF/RG: Yeah, yeah, that would be good.
TJ: It's always good to have a little bit of ambient noise.

Sound Interference/Sound Overload Between Spaces: Split Attention Others found the high level of ambient sound from other visitors to be a serious focusing distraction. Or sounds from different exhibit areas equally inhabiting one area, creating split attention. In another, earlier study (completed for a presentation at the American Alliance of Museums annual conference), groups of ADHD/dyslexic teens were taken to three different types of museums to compare and contrast how they did nor did not accommodate their learning needs (The Oakland Museum History Hall, the San Francisco Museum of Modern Art, and the Exploratorium). The reviewers reported being adversely put off by sound elements that bled into the entire museum space beyond the area of focus—tribal chanting in an introductory small diorama at the Oakland Museum and a set of large talking lips at a video installation at SF MOMA. These uncontainable, uncontrollable sounds drove them to get as far away as they could until the intrusiveness effect was eradicated.

Our pre-frontal cortex gives us the power of focus and attention, without which we would not really be fully human. Maintaining focus and attention is effortful and limited, however. We cannot truly multi-task in this regard, since anything other than the one thing we truly want to focus on has to be so routine as to not demand our attention, such as musing about your day ahead while brushing your teeth. To intently attend to one thing or one meaning requires NOT attending to others which may *distract* us—pulling us away in a negative sense (Klingberg 2009). Psychologists call this capacity selective attention, and shoring it up can be draining. Our brain

comprises only about 3% of our body weight, but it consumes 20–25% of our blood sugar (Bruya 2010; Lynch and Granger 2008).

All of these considerations raise a serious point—the brain will conserve resources whenever and wherever possible. It will seek routinized short cuts on how to make sense of its experience. And while it is happy to open itself up to novel learning, that comes at a steep price—one we call museum fatigue, which Beverly Serrell (1998) has famously reminded us kicks in around 20 min into the average visit. So it had better be deemed worth the while. Any work the brain has to do just to get started binding things together, to figure out which is which and what is what, will wear it down and create, quite literally, bad associations. Dioramas normally can help the brain overcome these challenges since as exhibits they exist in separate spaces, or appear as self-contained units. But museums can be large, noisy, complex spaces, and exhibits can inadvertently exert not an attracting and holding power, but a perplexing and repulsing force.

VF: And I think another thing… you're standing there and you're reading and all of a sudden you're hearing somebody behind you, you totally lose where you were because you're focusing so much on trying to read that, but then if you've got, like I said, the background noise and somebody is coming up, it just all starts to go together…and you just lost it and it's okay, where was I? Do I go back? But I find myself, when I start looking at sentences and if I see too many words (snaps fingers) right off the bat that I know I'm not…I'll just walk away because it's just too much….

….

VF: I found that in the beginning of going through the exhibits I really got it, but then when I got more and more people, the noises…much more…I started to lose concentration of what I was really looking at. But I think with an audio, you can block that out…

(general talking over each other)

TH: If you're standing over here, you know, with a push-down handle, and someone's going on with that and next door you've got another one going, you've got two different ones going at the same time and you're trying to listen to both of them and you're being interrupted…(general laughter and talking)

PG: You're bouncing back and forth, right?

TJ: I'd be like…oooooh, okay, I'll go somewhere else.

PG: Right. (laughs) Exactly.

Metaphoric Underload As discussed above in the positive effects of sound, a critical issue is to bring the objects to life. Part of this cognitive challenge is not just to integrate immediate sensory input, but then to translate that recombination into an imaginative "enlivening" of the scene in which "being here" becomes "being there." One might think of this as a metaphoric leap, in which one thing is directly

related to another. In this case, the "dead" objects, their setting, and their arrangement are all to be re-processed into a re-creation of a different time and space.

A challenge for dioramas is getting some viewers past this metaphoric hurdle, since they feel that they are just looking at stuffed dead things in an artificially contrived context. Researchers probing the neurological underpinnings of metaphor speak of conventional and creative—or novel—metaphors, the former being ones commonly assumed and quickly applied and the latter being ones having to be generated on the spot (Beatty and Silvia 2013; Kasirer and Mashal 2014; Lai et al. 2009). It appears that adults do better than teens or children with generating and applying conventional metaphors, since these kinds of metaphors are directly tied to amount of vocabulary and experience with idiomatic usage of language. Interestingly, persons on the autism spectrum as well as persons with ADHD can at times miss promptings to apply conventional metaphors in a space, as they look at objects or hear sounds very concretely (and at times acutely), and they may have less-than-average ease with conventional language use until full adulthood (Martin 2015). Temple Grandin is apt on this point, citing Tim Langdon "…people with autism were better at seeing 'pure pattern' rather than 'social pattern" (Grandin and Panek 2013). The flip side of this very literal tendency, however, is that such people can be much better than neurotypicals at applying creative metaphors, ones very idiosyncratic to themselves and the situation at that moment (Kasirer and Mashal 2014). What these persons show us is that humans are adept at confabulating when not having other ready-made explanations at hand. Most people seem to apply to dioramas whichever ready-made metaphor is offered by the museum (e.g. different California coast ecosystems), probably since that is the easiest immediate solution (Livingston 2015). However, not all do, or they may find it falls flat in some ways, which could be true not just for persons with ASD, ADHD, or dyslexia, but for all pre-adults and persons with English as a second language. And so they are left with disaggregated objects that they can either choose to combine in novel ways or leave to their inertness.

None of the reviewers of this study touched on this point directly, so it is important to turn to persons on the autism spectrum who may have particular challenges with this kind of required leap into *conventional* metaphoric play, and with acute sensitivity to sound and sight stimulation (which would further obstruct easy binding of a space into an "obvious" meaning). A special issue of *Westmuse* (Winter 2007), the quarterly publication of the Western Museums Association, was dedicated to the topic of Neurodiversity and Museum Practice. One of the contributors, Melissa Rosengard, related taking her son Nicky to the Oakland Museum "to check out the Natural Science dioramas filled with birds and animals in their natural California habitats." She then goes on to relate:

> One particularly vicious scene involved a large predatory bird swooping down on a small mammal, and I took the opportunity to weave a story for Nicky about the lethal hunger of the bird and the unwitting foraging rodent—attempting with drama and flourish to make the exhibit come alive. Yet when I finished my little "epic", Nicky simply looked at me quizzically and said, 'Mom, the bird can't eat the rat…he's dead.'

Nicky is a child with Asperger's Syndrome (AS), a challenging condition on the autism spectrum for which there is a pretty clear line between fact and fiction. If a story is meant to impart values through metaphor or other abstract means, Nicky will miss it; he needs things explicit and fact-based. Nicky also has Attention Deficit Disorder (ADD). ADD is a condition that makes it challenging for Nicky to focus on one thing, one speaker, one concept, because his brain is a whirl of so many other thoughts simultaneously.

5.6 The Take-Aways

What Dioramas Do Best for the Brain

- Dioramas facilitate sensory integration.
- Dioramas facilitate contextualizing language, by familiarizing abstract text.
- Dioramas facilitate imaginative exploration, by enlivening "dead" objects, especially when sound and vision are intuitively integrated in the diorama environment.
- Dioramas facilitate physical and symbolic way finding, by explicitly embodying a pathway from the concrete to the abstract. And by making the application of a conventional metaphor to set a scene more intuitive.
- Dioramas facilitate a feeling of "getting it," which opens up psychic resources and resilience for exploration, play, and discovery.

How to Promote What's Best in Dioramas One size does not fit all, so different types of dioramas are needed. Within a larger exhibition, there can be both busy immersive ones and quiet, meditative ones. Some like it slow and some like it fast, and all of us probably like a mixture of both at different times.

Within this continuum, almost all kinds of learners can find dioramas of real enjoyment, and possibly prefer them to other exhibit types.

When creating dioramas and their component parts, including text, as much attention should be paid to how and why they accommodate cognitive and physical vulnerabilities as to how they inspire and motivate higher-level cognition. The two are fully entangled.

Plan for visitors assuming that they come in with vulnerabilities, cognitive and physical, and would greatly appreciate and feel more welcomed if these were accommodated. While flattering, it can be intimidating and very exhausting for visitors to be only treated as functioning at the highest level in all ways for most of the duration of any visit.

Dioramas embody a basic dictum for exhibition design and interpretation: the easier the access, the more extended the complex outcomes. Helping the brain to bind things together quickly at the outset leaves more psychic space, energy, and willingness for playing with what's there. Don't drain the visitors' cognitive, emotional and physical gas tanks just trying to get started with the material on display.

Dioramas can be offered on designated days/times so that the volume and pitch of sound elements can be adjusted for visitors with low auditory sensory stimulation thresholds.

Dioramas can be offered on designated days/times to fewer numbers of visitors, accommodating persons with low physical contact thresholds, who have limited mobility issues, and/or who like to explore slowly and quietly.

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Chapter 6
The *Digital Diorama* Project: A New Way of Exploring Dioramas from Outside of the Museum Setting

Annastella Gambini

6.1 Museum Dioramas

A natural history museum is a special place that is full of atmosphere and stands out from other locations in the perceptions of both school groups and adults who have long since left school. Targeted science learning may be stimulated, enriched and facilitated by exploiting the resources to be found in these museums, especially when they are transformed into true *learning environments*. Availing of learning experiences at the museum, which is accessible outside the hours of regular educational or professional commitments, therefore represents a good opportunity for *lifelong learning* (Usher and Edwards 2007).

The resources present in museums include dioramas, which are artificial environments scientifically modelled on natural ecosystems. Dioramas are constructed on the basis of three-dimensional paleontological findings and offer audiences true "windows to look into" giving them a real sense of place (Endersby 1997; Garibay group 2014). They are typically made using the most advanced materials available, and often have the power to make observers feel as though they are truly immersed in the reconstructed environment: in the midst of a hunting scene or in absolute silence …sounds and smells are almost perceived as real… Some dioramas have great aesthetic, ecological and paleontological value and, given the skill and professionalism with which they are constructed, offer both study material and the scope for generating broad impact.

Some also bear historical value, both in the sense of providing a record of how ecosystems have changed over time, and in terms of conserving styles and perspectives of the past (Wonders 1993).

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Thus, dioramas are a valuable museum resource, not only on account of their disciplinary content (biology, ecology, geography, etc.), but also from a historical point of view. They are authentic cultural heritage. They are generally enjoyed alongside collections and other special resources in museums, but deserve to be recognized in their own right (Morris 2004).

6.2 Non-formal Education

Nowadays, differently to in the past, school is no longer the only place in which information and learning may be acquired. What is more, many disciplines can now be explored in novel ways, using multiple and constantly changing resources. It is widely acknowledged that such innovative tools cater for the needs of the knowledge society – including lifelong learning – and attract the interest of young people, helping them to attain learning outcomes of everyday value.

A crucial priority today (perhaps the most crucial) is to enhance people's appreciation and understanding of environmental complexity by teaching it at school while simultaneously encouraging "non-formal" types of teaching/learning (One way of doing this is to develop *learning environme*nts that may also be implemented in non-formal settings, such as museums (Bell et al. 2009). Here, people can develop their interest in science, engage in scientific inquiry and reflect on the experience gained (Herrington et al. 2014). However, the most crucial feature of these *learning environments* is that participants are invited to work together (Dillenbourg 1999).

In *learning environments*, each individual is an active and fully-committed member of a community, and each helps to complete a task or shared project, contributing his or her own experience, knowledge and skills to the building of collective knowledge and learning via group discussion and interaction (Pezzotti et al. 2014). The tool for which the digital dioramas have been developed is the IWB (Interactive Whiteboard): a tool that is currently under-utilized, and above all under-exploited, in Italian schools. To date, few educational activities have been specifically designed for the IWB or other digital technologies. The IWB is located in the classroom or in a public space: an object that does not need to be booked, moved, or installed… it patiently waits for someone to touch it, to open up its hidden interface and get in touch with the world via its specially designed learning systems…

The full educational potential of the IWB (often used in schools) is expressed when it is used as a "cognitive space", in which students are invited to construct their own learning via research, cooperation and problem solving (Pezzotti et al. 2014).

Exploiting the synergies between non-formal learning in museums and school learning can foster the widespread dissemination of scientific knowledge. One possible approach is to design coordinated learning programs to be implemented across both settings; another possibility is combining museum resources (such as dioramas) with aspects of school methodology (IWB and collaborative learning). The *Digital Diorama* project offers just this type of synergy, bringing together these two

elements which mutually reinforce one another. In this way, a museum resource may be turned into a real *learning environment*.

6.3 Connecting Museums with Citizens

Very often the inhabitants of larger cities do not visit museums, because they find them alien and unappealing.

There are three main reasons why the majority of people do not regularly visit natural history museums:

- they live far away from the larger cities in which these museums are located
- they live in cities with museums, but are disinterested; they are not attracted by nature and science (this category includes immigrants from different cultural backgrounds who may not be competent in the local language).
- they attend schools that do not have the resources to organize field trips and in which the teachers are not skilled in exploiting non-formal learning methods.

Our digital dioramas (henceforth DDs) are interactive digitalisations of museum dioramas, designed to make these exhibits more attractive to the public. Each diorama has been transformed into a multimedia experience, offering the possibility to navigate the different features of the natural setting represented and their peculiar characteristics. The diorama is used as a basis for pointing out relationships and processes in natural environments, including those closer to home: the woods behind one's house, a swamp, a pond, a river, etc. In other words, diorama users are prompted to re-experience in their everyday lives selected characteristics of the distant environments represented. For example, the dependence of life on the intensity of light, the presence of water in the soil, anthropic impact, etc. Building up this kind of detailed ecological awareness could lay a solid foundation for the development of responsible environmental and social attitudes.

The DDs may be used in two different ways. First, in the context of a study group, in which they may share their curiosity and interest with other learners. This educational method is aimed at helping learners to make more sense of their competences and skills while also developing intercultural behaviours (Dillenbourg 1999). The other way is in the museum itself, no longer perceived as alien, but as a space that draws together many stories (evolution, the lives of scientists, animal life cycles, the planet earth and the cities of the world, etc.).

6.4 The Digital Diorama Project

The *Digital Diorama (DD)* research project was funded by the Italian Ministry of Education, University and Research, and led by the research team for biology learning at the University of Milano-Bicocca (Gambini et al. 2014).

We carefully chose the multimedia interface developer to build up the DD. This expert focused not only on the graphic aspects of the different levels to be used, but also on developing specific links between the different sections. We also recruited an expert photographer to take shots of several of the museum's dioramas including close-ups of their individual elements which were, in the end, used for browsing between the different elements.

The research team went through a learning curve to acquire the technical skills needed to further develop the DDs, that is adding extra materials such as videos, photos and texts, to enhance exploration.

The project, which included all the phases of development and experimentation of the DDs was completed in mid-2016. In order to promote our work, we started a period of presentations, interviews and so on, to underline this novel approach to learning biology and enhancing awareness of the natural environments.

Up to now four DDs have been developed: which were photographed at two Natural History Museums, one in Milan and the other in Livorno.

The environments represented include the Mediterranean Sea, North American River Rapids, the Canadian Boreal Forest and the Amazon Rainforest. These DDs are interactive interfaces consisting of the central image of a high-resolution wide-angle photo of the entire diorama (Poli et al. 2017).

While scrolling over the main image, the user can zoom enlarging it. This zoomed image may be viewed from three different perspectives to enable more in-depth examination (somewhat like standing in front of a museum diorama).

Opening the menu four different levels of exploration are available. Each level includes a selection of hidden "hotspots" (generally seven or eight) which are revealed on touching the IBW or scrolling over with a mouse.

Each hotspot, which is strategically placed, leads to more detailed content (Fig. 6.1).

At the first level of exploration, a narrator invites the users to enter the diorama, use imagination and create their *imaginary journey* throughout it. Thus, at this level, users are encouraged to develop their own personal interpretation of the diorama, and to bring it to life. Users are asked recorded audio questions to steer them through the environment they themselves are reconstructing: fear and curiosity, sounds and

Fig. 6.1 On the left, the North American River Rapids DD with menu, at the bottom, offering the different levels of exploration of the diorama. On the right, the same diorama with same hotspots appearing on the bears, the salmon, trees etc

smells. This adds some more dynamic aspects to museum dioramas and they become a series of single frames each one following the other.

The second level, presents hotspots leading to contents of core ideas common to different living things. We have labelled these *crossover topics* (e.g., movement, hunting techniques, reproduction strategies, etc.). Each *crossover topic* is developed with five different multimedia items (diagrams, images, videos), with explanatory captions (see Fig. 6.2).

These *crossover topics* represent the core of the *DD* project: they draw non-linear – as opposed to linear (Gambini et al. 2016) – connections among biology topics and they provide learners with the basis for developing a highly complex conceptual map.

This level also offers content on the relationship between the environment and human activity, conservation and sustainability studies. Importantly, some of the multimedia content evokes aspects of everyday life: for example, some aquatic animals filter water to feed are immediately compared to objects in daily use, such as a tea bag, a colander, etc.

At the third level, each hotspot gives access to an *identity card* with a series of brief questions and answers (FAQs) which describe the elements in question and may be consulted at any time during exploration of the DD.

Again, the characteristics of the described animal (or any other element) don't follow a pre-set pathway: users need to choose the type of information they wish to consult from among a series of options. For example, in Fig. 6.3: Morphology, habitat, feeding, life cycle, social organization and conservation.

The fourth, and final level, shows *educational experiences* that may be associated with some of the *crossover topics* addressed in the DD. This enables learning by doing to take place in parallel with the exploration of the DD (Freeman et al. 2014). For example, the *Boreal Forest of Canada* DD includes three *educational experiences*: one about ants, one about the organisms that live in the soil and finally one which is a guide to the setting up further personalized hotspots. All the links at this level offer protocols for carrying out the proposed activities (Fig 6.4).

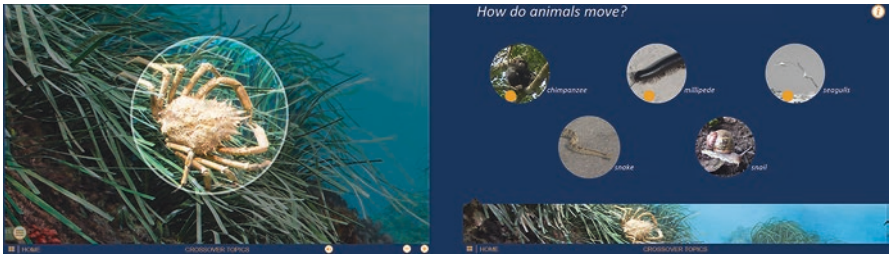

Fig. 6.2 On the left, by clicking on the spider crab, users can access the crossover topic of movement (How do animals move?). On the right, the topic is developed in videos showing the movement of chimpanzee, millipedes, seagulls, snakes and snails

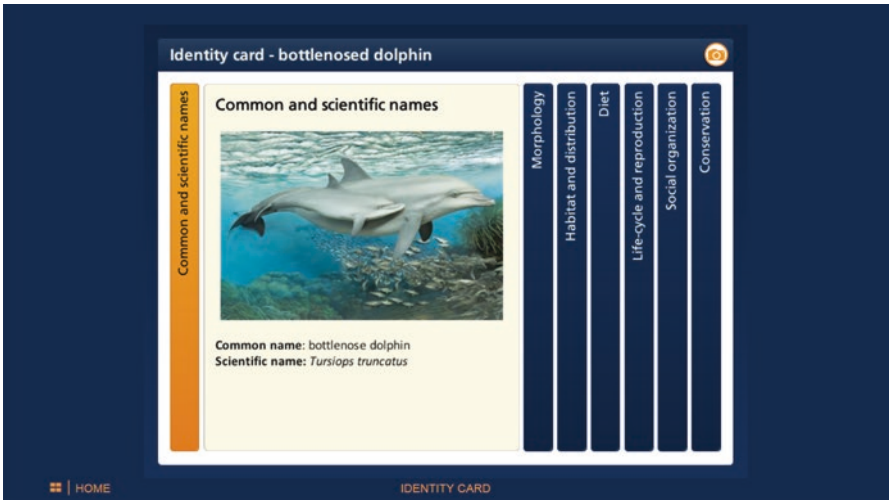

Fig. 6.3 Identity card of the dolphin from the Mediterranean Sea DD

Fig. 6.4 Suggested educational activities in the Boreal Forest of Canada DD

6.5 Digital Diorama Website

A website has been developed providing detailed information on how the DDs were produced and how to go about exploring them.

The website (*digitaldiorama.it*), shown in Fig. 6.5, is organized around a horizontal menu offering key information about the project under a series of headings (aims of the DDs, how to use them, background on dioramas, where they are located

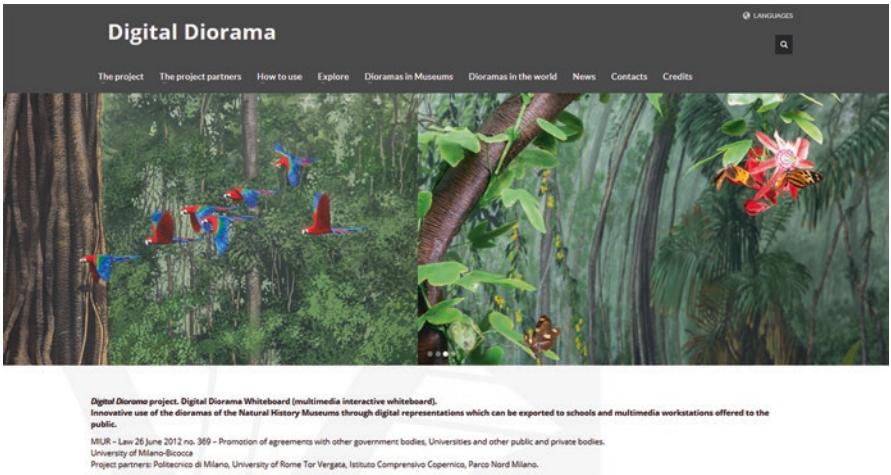

Fig. 6.5 *Digital Diorama* website (digitaldiorama.it)

in the world, recommended reading, contacts, etc.) The site is rich in visual content. The explore section of the menu provides direct access to the four existing DDs.

6.6 Description of a Crossover Topic

While exploring the Amazon Rainforest DD, at the *crossover topics* level, users encounter a hotspot placed on the seeds of the rubber tree. This is the lead-in to the *crossover topic*: extension of the breeding area (See bottom of Fig. 6.6).

The topic is introduced by the phrase: "Sooner or later, babies leave their parents", and is developed in the course of five video-clips of representative cases. Each video bears a short caption designed to stimulate discussion or reflection. See Table 6.1 below.

The screenshot in Fig. 6.6 features a link (*I*, appearing top-right) to a short text (for teachers or in-depth learning) giving an overview of the theme and describes how the five case studies are related to it. The following is an extract from a text:

> ……. Some seeds will inevitably be eaten, while others will continue to travel until they reach a place to germinate. This is how the "babies" of one of the forest giants leave their parents……. Growing in the same place means sharing the same resources. The offspring of a tree, for instance, will be competing with their mother and among themselves for the soil minerals, water and light. Because of this, plants prepare their seeds to travel as far away as possible.
>
> Maple, lime, and elm fruit, like the seeds and fruits of many grasses such as epilobium, are light and have thin extensions that facilitate their movement. On a dry day, if stimulated by a draught of air, they separate from the mother plant and "float away" on the air.
>
> The burdock fruits are quite big, they have no extensions and do not roll on the ground. They can only move if someone is "willing" to carry them. Specifically, they stick to the fur

Fig. 6.6 The crossover topic is developed from the hotspot over the rubber tree seeds in the Amazonian Rainforest DD

Table 6.1 Captions designed to stimulate discussion

Videos	Captions of the videos
Coconut palm	The coconut fruit is transported by ocean currents that move it away from the tree it fell from.
Swarms of bees	When the density of worker bees is too high, some must leave.
Epilobium	Just a blast of wind and these fruits will fly off.
Burdock	The fruits of the burdock have a particular means of transport.
Nutcrackers	Some seeds are left on the ground, others are carried away…

of animals such as foxes, badgers, bears, deer, etc. which then unknowingly give them a "lift".

Nutcrackers store pine nuts in several different places in order to have a good supply. They gather them in piles, generally next to big boulders in open spaces and they later hide them in underground holes. Some of the nuts get left behind or are never collected for eating. They may germinate and grow.

Also in the case of animals, babies can leave the parents to increase their chances of survival, hence extending the breeding area of the species. Sometimes the young are abandoned in the early stages of their lives, while in many other cases this occurs after a certain period of time spent with the family. Grizzly bears stay with their mothers for a few years before heading their own way.

Bees, like other insects, live in colonies that can reach a considerable size……When a new queen is born, one of the two leaves the beehive, followed by a large number of worker bees. Some worker bees go on a reconnaissance mission to find a place to build a new beehive. Before leaving they store a certain amount of honey, in order to survive the first days spent working on the new hive.

6.7 Our Aims

Changing educational paradigms is a key priority for a future that has never been as uncertain as it is today… The so-called linear method of teaching needs to be replaced by a non-linear approach, based on making associations, linking concepts, uncovering crossover topics and, as an extremely ambitious objective, developing a systemic perspective on the reality that surrounds us (Carrol 2007).

Targeted science learning can be stimulated, enriched and aided through the exploration of dioramas, especially when they are remodelled into true *learning environments*, available either in schools, or in non-formal education contexts and which are also available to the general public. The *Digital Diorama,* an Italian project funded by the Government, is an excellent example of such environments.

One of today's most crucial priorities is to boost people's interest in science, introducing them to building a collective knowledge and learning through discussions and interactions. This could be enhanced applying the Digital Diorama, a multimedia interactive interface that employs specific software working on IWB. This also permits us to offer a reticular rather than linear way of learning, and in so doing may stimulate a true awareness of the complexity of environmental problems and, as an extremely ambitious objective, developing a systemic perspective on the reality that surrounds us. (I define this aim as ambitious because it is essential to acknowledge that it is most difficult to achieve…) (Gambini et al. 2013).

In its list of actions for promoting conservation, IUCN explicitly commends endeavours to raise awareness, a goal that can only be pursued by increasing the knowledge available to the general public rather than keeping it within the scientific community. If people have not developed a basic grasp of the issues at stake, their behaviours will be driven by slogans and emotional reactions to the charisma of a communicator, rather than based on conscious, free choice.

It is critical to promote a sense of common stewardship of the world and of our cultural heritage, which means learning how to share with others and how to participate in a circular exchange of information and resources. It is also crucial to realize that our survival depends, in part, on exchange with other parts of the world, just as part of our culture was developed by others, in the distant past.

The DDs have been specially designed to stimulate reflection and facilitate group discussions leading to a better understanding of these relationships. Furthermore, the multimedia content makes frequent reference to aspects of everyday life. This could help people adopt more sustainable socio-cultural habits. The DD method is designed to stimulate individual creativity and the development of greater responsibility for carrying out sustainable actions, not based on rules but on individual choice.

Another objective of the DD is to encourage learners to compare local ecosystems with those in other parts of the world. Awareness of faraway ecosystems helps people to perceive themselves as citizens of the world.

The virtuous learning of these concepts stimulates new ways of integrating information, different cultures, and different world views.

Finally, it is of the utmost importance to foster awareness that all parts of the globe are interconnected and mutually dependent on each other for ecosystem services.

An everyday example of this would be buying bananas from Costa Rica without asking oneself how they are produced, and at what environmental cost to the land, or how the workers are treated and what their working conditions are like.

Using the DD offers people a direct perspective on the close relationship between our individual behaviour and ecosystems, even those located on the far side of the planet.

Making such themes and objectives, albeit only virtually, part of museum communication activities means endowing the mission of natural history museums with new meaning and value.

6.8 Digital Diorama Methodological Issues

DDs are interactive systems that focus on users and their "cognitive interaction" with features of the represented environments.

They are tools for exploring and interpreting biology contents and launching "in-depth investigations", with a view to stimulating questions, interest, and discussion (if used in schools or in the context of group IWB-sessions) at a range of interconnected levels.

The multimedia objects in the DDs constantly evoke aspects and features of everyday life, which is key to ensuring that these educational activities become a source of knowledge for all areas of life. In addition, the DDs systematically suggest connections among the great unifying themes of biology, while avoiding traditional, linear, predefined learning paths (Gambini et al. 2016).

Finally, the DDs have been designed to leverage on the emotional aspects of the knowledge acquisition process. The DD suggested method of use is aimed at associating the information learned with emotional responses that are often excluded from the teaching of science.

This is based on the understanding that emotions and affection impact the process of learning at school and in everyday life, and that valuing these aspects can enhance cognitive abilities in people (King et al. 2015).

New technologies, if properly exploited and used according to social constructivist principles, may become key amplifiers of interpersonal communication and cooperation (Duffy and Cunningham 1996). Technologies are not only a means of sourcing or distributing contents, but represent an opportunity for encountering, discussing and learning through interaction with others. In this sense, technology can become a true "intellectual partner", offering valuable teaching devices that facilitate meaningful learning (Hanna et al. 1999; Nesset and Large 2004). Each person becomes the author of their own learning process.

After exploring the DD, learners or learner groups are invited to accomplish a creative product developed using the IWB (conceptual maps, drawings, photographs,

questions for the experts, etc.), enabling further evaluation of the usership and of the use of the DDs.

Materials for guiding the discussions are provided to teachers and practitioners via the DD interface. Topics may be addressed and freely linked to one another, in any order, as dictated by the background knowledge and interests of teachers and operators.

During the experimental phase of the project, the first group of teachers who worked with the DD were required to possess specific disciplinary knowledge and skills and specific competence in new technologies.

A future development could be the setting up of e dedicated online forum on which expert museum educators and teachers would share their experience of using DDs with peers.

These forms of in-service training may also be extended to university students interested in acquiring the specific skills required to use the IWB and the DDs.

Another key goal is to contribute to, and encourage the training of, those who are directly responsible for the diffusion of scientific knowledge and the promotion of museum heritage in both formal and non-formal educational contexts.

The use of videos and photographic images combined with minimal text fosters interest and communication. However, the most innovative aspect of the DDs is the drawing of connections among different elements in order to introduce users to key overarching biology and ecology themes. This emphasis on forming connections encourages non-linear learning, giving users experience in making creative and personal associations that are potentially more in keeping with the complexity of biological systems.

The DD achieves these educational aims by harnessing – and training users in – modern forms of communication that are suitable for audiences from different backgrounds and age groups.

6.9 Promoting Knowledge of Cultural Heritage

Further aims of the *Digital Diorama* project include contributing to: raising awareness among the general public about the use of experiential dioramas as a resource of great historical, aesthetic, scientific and ecological value; expanding the mission of natural history museums via ad hoc agreements with universities with the support of local and regional authorities; equipping natural history museums to engage in the large-scale dissemination of their heritage assets via the use of new technologies.

In addition, we have begun to develop a new section of the DD site that will launch construction of a database of existing dioramas in museums around the globe, with a view to fostering the large-scale dissemination of the world's dioramas, comparison among them, familiarization with faraway dioramas, and active "on line" exchange initiatives.

Two transitions are currently underway. On the one hand, museums, in addition to their key role in conservation and specialized study, are undertaking the dissemination of scientific information. On the other hand, schools urgently need to educate their students about crucial environmental issues: not only by providing basic knowledge, but also by fostering responsible individual attitudes towards the natural environment.

The *Digital Diorama* project outlined here integrates both of these transitions, facilitating and reinforcing them via the innovative use of new technologies.

Thus, a future extension of the project might involve installing DDs in urban areas in which people spend time waiting (government offices, train stations, hospital waiting rooms). This would truly contribute to bringing real-life resources from natural history museums to the knowledge of audiences of all ages and backgrounds, raising their awareness of cultural heritage assets of great appeal that are currently enjoyed by all too few.

6.10 Evaluation and Distribution

The *Digital Diorama* project has been evaluated from multiple perspectives and using a range of instruments. We have examined the quality of the interface, quality of user interaction, and the dioramas' effectiveness in improving the learning of selected key aspects of biology and ecology. The first assessment conducted was quantitative (Poli et al. 2016), while the second involved the use of qualitative research methods.

The latter comprehended the monitoring and observation of classroom work, focus group discussions with teachers, collection and analysis of products (maps, drawings, reflections, brief texts, Internet searches, etc.) created by students during and after exploration of the DDs.

To date, the DDs have been piloted in about 20 schools throughout Italy. We chose primary and lower secondary schools (ages: 6–14 years) as our educational target. The overall outcomes obtained were positive, leading to some schools establishing contact with geographically distant museums with a view to organizing visits to them at a future date.

In relation to the use of the DD, a crucial step was the provision of ad hoc training to the teachers involved in the pilot phase. The researchers also set up an online forum to facilitate discussion both among the participating teachers and between teachers and the research team. However, despite the efforts of the researchers moderating the discussion, the teachers made limited use of the forum.

Some of the children and adolescents involved in the pilot phase learned to apply the non-linear approach and used it to creatively develop a final learning product of their own.

For example, in response to the invitation to invent a new hotspot, a group of students from Messina came up with the concept of dwelling/home. In the process of producing their own original hotspot, they successfully followed the *crossover*

topic model by linking together five drawings explained using captions: a clown fish among the tentacles of a sea anemone, a squirrel in a tree cavity, a stork's nest, a hermit crab in a shell and finally human dwelling-places outlined in four steps, from caves to skyscrapers.

Since April 2016, three DDs have been installed in public spaces, where they may be observed and explored by passers-by. To date however, the nature of the locations means that audiences are relatively select. The first location is the entrance hall of a Milan-Bicocca University campus, a building that houses non-scientific departments and administrative staff. Trained staff, who are competent in using the DDs and familiar with their objectives, are sometimes present and can guide exploration of the DDs.

The second setting is the Museo di Storia Naturale di Ferrara where the DDs are available on IWB in a dedicated area: clearly, given the nature of the museum, visitors are predisposed to be interested in the natural sciences. The third and final setting is the Parco Nord Milano, an urban park that is a partner in the DD project given its strong commitment to biodiversity education.

However, interesting evidence of the broader appeal and applicability of the DD was gathered 2 years' ago – on the occasion of *European Researcher's night* – when the first prototype of the DDs was presented to the general public. Children and teenagers, in particular, spontaneously interacted with the IWB, exploring all the DDs competently and without hesitation. This initiative was repeated in the autumn of 2016 with the final editions of the current four DDs, and an English-language version for non-Italian speakers.

With regard to the future diffusion of this technological and pedagogical instrument, we next plan to investigate the impact of the DDs on members of the general public who have explored them in the three public spaces in which they are currently installed; this will enable us to assess the effectiveness of implementing this new method of communication also in non-school settings.

6.11 Conclusion

Today, new methods are required to optimise learning and knowledge – especially where distant environments are concerned. The DDs are interactive multimedia interfaces devised to disseminate knowledge about faraway environments, and a resource that may be flexibly located in museums, other public places or schools. Awareness of faraway ecosystems is important because it contributes to people's sense of being citizens of the world. Exploring the DDs may provide users with a perception of the close relationship between individual behaviours and the status of ecosystems on the other side of our planet. This is one of the aims of sustainability education (Sterling 2001).

In addition, the DDs have been specifically designed to apply three different methodological approaches to the scientific interpretation of nature.

Firstly, exploration of the DDs stimulates non-linear learning. This is a much-needed innovation that yields more satisfactory outcomes than the traditional linear

approaches still prevailing in our schools, museums and information systems. The distinctive value of the *Digital Diorama* project is that it prompts users to follow nonlinear learning paths (leading from an element of a diorama, via a *crossover topic*, to other elements), resulting in the development of a complex conceptual map.

Secondly, the type of multimedia communication used in the DDs, which mainly relies on visual contents such as photos and videos, is suited to a wide range of audiences, including foreigners who have not yet acquired full Italian/English language proficiency.

Finally, the DDs offer an ideal basis for posing open questions and inviting users to formulate questions of their own, rather than passively observing a sequence of images or listening to the words of a museum guide. In the context of a small group, this will give rise to exchanges of opinions and reflections, generating truly collaborative learning. The same mechanism could also be exploited in the context of a dedicated online forum or social media.

Exploring the DDs engages users' attention more deeply than viewing an array of dioramas while walking through the galleries of a museum. Particularly in the absence of a guide, visitors to museums tend to view dioramas somewhat superficially and hastily. Meaningful exploration of the DDs requires an investment in terms of time – like all reflective activities – but offers the advantage that it is not subject to the time and space constraints of a museum visit. For people who have never been to a natural history museum before, encountering the DDs may motivate them to visit one; in this case, they will be rewarded by experiencing the atmosphere of the original diorama in the museum setting, a dimension that the digital reproduction clearly cannot convey.

Furthermore, museum dioramas are nowadays very costly to produce. Hence, the virtual access provided by the DDs, which exploit innovative communication strategies and may be implemented on a large-scale, can make a valuable contribution to enhancing knowledge. This knowledge concerns museums, dioramas and the complexity of the planet's natural environments.

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Part II
Problematic Aspects of Dioramas

Chapter 7
Life, Living and Lifelessness in Taxidermy

Luanne Meehitiya, Dawn Sanders, and Jill Hohenstein

7.1 Introduction

This chapter extends and further develops a recent paper by two of the authors, Sanders and Hohenstein, by both drawing in a curatorial perspective and examining potentials of specific taxidermic displays for learning conversations. In the aforementioned paper we drew attention to research on the ways taxidermic display is currently used, the ways children learn through family conversation, and the types of understandings children are known to have about life and death. Our belief that these collections represent potential research spaces for understanding the impact of parental communication on children's understandings of life and death underscores a guided reflection on the merits of taxidermic display for demonstrating ways in which families discuss concepts of life, and death. Furthermore, we maintain that such studies might facilitate new interdisciplinary relationships between museum curators and researchers, thus contributing to wider debate on the place of natural history collections in society.

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7.2 Beyond Mute Skins

Taxidermic exhibits are both culturally and experientially complex (see for example discussions in Alberti 2005, 2008; Baker 2014; Burt 2008; Patchett and Foster 2008; Poliquin 2008, 2012; Sanders and Hohenstein 2015). In the context of life, living and lifelessness, Poliquin notes that 'if taxidermy can no longer be unproblematically read as nature, neither can taxidermied animals be simply understood as mute mounted skins.' (Poliquin 2008, p. 125). In the following extract Poliquin makes the materiality of nineteenth-century taxidermy and its narratives extant:

> In spite of the death, the skinning, dismemberment, and refashioning, the animal form holds. The eyes may be glass, but the animal stares back. An animal – even if taxidermied – is not an arbitrary object, materiality indistinguishable from a bowl or a painting. The astounding realism of the Blaschkas' glass flowers is not the same as that of the animals in the African Hall's dioramas since the verisimilitude of the latter is not technically verisimilitude: these are the actual animal skins. This uncanny animal-thingness of taxidermy has the power to provoke, to edify, and even to undermine the validity its own existence. (Poliquin 2008, p. 127)

It is the liminal, uncanny quality of taxidermy, the flickering switch between life and death, nature and culture, which is always remarked upon (e.g. Andrews 2012; Patchett and Foster 2008; Poliquin 2008, 2012). Engaging with taxidermic exhibits can be perceived as being as much about life and living as about death, and, thus, as Burt observes, can equally be framed as 'an aesthetic of livingness' (Burt 2008). Furthermore, 'because death is so striking it is easy to overlook the state of livingness' in such museological contexts (Burt 2008, p. 9). However, some commentators have argued that 'not all dead animals are seen as equally dead' (Baker 2014, p. 290). Poliquin, for example, posits the view that those taxidermic displays which present 'just heads', are considered to be 'decidedly deader' (Poliquin 2012, p. 151).

In this chapter, in particular, we are interested in the following questions:

(a) In what ways are family visitors with small children affected by encountering something 'at once lifelike yet dead'? (Poliquin 2008, p. 127)
(b) How might display influence family visitor perception of the 'fine lines between life and death'? (Patchett and Foster 2008, p. 110)
(c) What is the potential for further research among visitors and developments in curatorial practice?

To address these, we use examples from two museum collections in the UK, Birmingham Museums Trust and the Horniman Museum, and frame our reflections with theoretical approaches drawn from both learning research and museum studies.

7.3 In What Ways Are Visitors Affected by Encountering Something "At Once Lifelike Yet Dead"?

Everyone who has worked in a museum containing taxidermy has probably, at some point, watched a person arrested in their tracks at the sight of a taxidermy display or an individual specimen, which appears to captivate them. Poliquin categorises encounters with taxidermy into descriptive, biographical, cautionary and experiential narratives. 'Experiential narratives arise not from textual accompaniments but from the physical encounter between viewer and thing' (Poliquin 2008, p. 129). Similarly, Bencard writes that some objects have *presence*, an impact that does not derive from narrative but 'lies in what happens when you actually see it' (Bencard 2014, p. 29). Often, when watching people approach taxidermy, 'it is as if such potential stories run at a different voltage than the immediate impact on the observer of the objects themselves' (Bencard 2014, p. 29). Experiential narratives and presence effects are both ways of conceptualising the arresting encounter with taxidermy and the unconscious meeting with life and death that may accompany it. We suggest that the opportunity to make such unconscious encounters conscious is one of the values of taxidermic display.

But in focusing on presence and experience, we should not forget narrative. Taxidermy displays both 'tell and inspire the telling of stories' and families have been shown to use dioramas in particular to craft narratives together (Reiss and Tunnicliffe 2011, p. 42). The importance of narrative may extend beyond dioramas to even the simplest individual taxidermy specimens. If you have ever conducted handling sessions with taxidermy you may have been asked by a child, 'Did you kill these animals?' or even, 'Why did you kill these animals?' This may be an example of 'narrative gravity' (Runia in Bencard 2014). In this situation the child is immediately aware of two facts: that the animal is dead and that you are here with it. We could speculate that the need for narrative is causing them to 'creatively and ruthlessly search for continuity between events' (Bencard 2014, p. 32).

It is perhaps not useful to debate whether presence or narratives drive the captivating interest observed in taxidermy, as it is probably a combination of the two. Both the experiential and narrative effects of taxidermy on visitors are surely linked to reflections on life and death. As Andrews observes, 'it could be argued that the liminal status of taxidermy is precisely what makes it so interesting to visitors' (Andrews 2012, p. 60). Taxidermy embodies the uncanny, 'something which ought to have remained hidden but has come to light' (Freud in Young in Bencard 2014, p. 36). By normal logic, dead things exhibit changes and are removed from sight, whereas taxidermy display renders them changeless and visible.

In the paper that inspired this chapter, Sanders and Hohenstein (2015) wrote about the potential of taxidermy to impact on children's understanding of life and death. They outlined studies into how children develop an understanding of death, noting that components of an understanding of death include universality, non-functionality, irreversibility, inevitability and causality (Hunter and Smith 2008; Rosengren et al. 2014). A taxidermy animal may appear to a young child to flout

these components of death, at least in part. That is, by presenting dead animals in 'life-like' scenes, they may have the appearance of functionality or even having had the death process reversed. This uncanny and potentially confusing quality of taxidermy may paradoxically aid the learning opportunity (Elwick 2015, p. 420). The life-like qualities of taxidermy may challenge young children's 'implicit learning' about death. Implicit learning may be defined as, 'learning we are not aware of, or learning which results in knowledge we do not know we possess or cannot articulate' (Elwick 2015, p. 420). Being confronted with an object that appears to violate a child's unconscious expectations about death may ironically force implicit learning to become more conscious. Moreover, children are likely to be accompanied in the museum setting by adults, and thus conversations about death may be initiated, possibly creating opportunities to explicate understandings about life and death.

As has been highlighted elsewhere (Barrett and Behne 2005; Hunter and Smith 2008; Jaakkola and Slaughter 2002; Rosengran et al. 2014), children's concepts of life and death have been documented to appear in rudimentary forms as early as the age of four and continue to develop over the course of the next several years. Parents in Western families often tend to shy away from discussing death with their children because of the attribution that young children are unable to understand. As attested in Gutierrez et al. parents who are questioned by their young children about death often respond with notions of reassurance (Gutierrez et al. 2014). In other words, they sense anxiety in their children around the possibility of death and attempt to help them to understand that what they are asking about is unlikely to occur to them or anyone they know. Given that the nature of the questions addressed in that study tended to be about media representations of death or about deaths of people or pets that were known to the children, it is likely that the parental interpretation of anxiety on the part of their children was not inaccurate.

When encountering taxidermied animals, which have no direct relation to children's, or indeed, families', experiences, the relative distance, in terms of affectionate ties, might enable a more frank conversation about the state of the displayed animals and the processes that led them to be in the museum. Moreover, the aesthetic of the displays themselves might be a factor in these attentional and emotional distances, as demonstrated in Case Studies 1 - 3. In addition, a recent study on visitor perception about the authenticity of taxidermied rabbits found that children and adults sometimes asked questions about the animal's previous state of life, particularly when they judged the displayed animal to be real (Bunce 2016). In contrast, children might spontaneously form emotional attachment to animals. Such responses are likely to be influenced by a range of factors that dictate the degree of emotion and identification felt for that particular animal. Such variables include the physical form of animal being observed (e.g. 'furry' mammals versus 'slippery' reptiles), dominant cultural perceptions of these animals (Fawcett 2014) and personification, the 'mapping of human characteristics to animals according to the perceived degree of taxonomic closeness' (Ash 2004, p. 90). Furthermore, the immediacy of the dead animal being *right there* in front of them may add emotional impact (see for example Pederson 2007). We are interested in exploring how such factors might impact on conversations.

The feelings of adults are of course also pertinent to children's learning experiences, since they interact together in the museum. We should not forget that learning about something as key as death continues throughout life. One form of knowledge is 'fully realizing things instead of just taking them for granted' (Runia in Bencard 2014, p. 31). The literature on adult's emotive response to taxidermy is surprisingly scant, although many writers mention in passing their ability to 'haunt us' and provoke a 'stab of emotion' (Marvin in Gregory and Purdy 2015, p. 92; Gregory and Purdy 2015, p. 74). We should in any case be aware of the possibility that all visitors to natural history displays may occasionally have profound, personal and perhaps unconscious experiences around taxidermy and other dead things in museums. Kirk found in her research into four and five year olds in natural history collections that museums were valued as, 'a safe space in which children and their parents could encounter their own and their parents' fears' (Kirk 2013, p. 41). These fears, both those of adult and child, may include death.

7.4 How Display Influences Perception

How does display influence the way people experience the living and lifeless qualities of taxidermy? The first consideration is the impact of the taxidermy itself. Taxidermy varies widely in style, scale, skill and condition (Morris 2010; Poliquin 2012; Sanders and Hohenstein 2015, pp. 253–4).

It may naively be thought that more accomplished and realistic taxidermy accentuates its life-like qualities and that more inept, inaccurate or damaged mounts flick the switch towards deathliness. However, it is not this simple. Reflections on life and death are so intrinsically linked through taxidermy that highlighting one only serves to bring the other into focus. Alberti writes how it is the 'meticulous verisimilitude' of the most life-like mounts that 'renders them uncanny' (Alberti 2008, p. 81). The success in evading the material signs of death only makes its reality more poignant and the viewer may well ask the dead (in the words of Shakespeare's Romeo to Juliet) 'Why art thou yet so fair?' On the contrary, dishevelled taxidermy creates a sense of wonderment that this animal was once alive, for 'if tattiness, imperfection and botched form count for anything, it is that they render the animal *abrasively visible*' (Patchett and Foster 2008, p. 100).

Alongside the qualities of taxidermy itself, the way it is experienced can be heightened by display techniques. These include juxtaposition of specimens and use of physical space, open or cased display, lighting and multi-sensory accompaniments to viewing such as touch and sound, as well as interpretation (Poliquin 2008, p. 129).

7.4.1 Case Study 1: Comparing Taxidermy Display Settings in Birmingham Museums

It is illustrative to compare how visitors respond to the same taxidermy collection differently within varied display settings. Birmingham Museums Trust holds a large taxidermy collection that is mainly displayed in three of its venues, Birmingham Museum and Art Gallery, Thinktank Science Museum and the Museum Collections Centre. The following examples are drawn from the experience of one of the authors (Meehitiya) as a curator at this museum.

In Birmingham Museum and Art Gallery selected taxidermy pieces are displayed in the 'Mini Museum', a bright, interactive gallery aimed at under-fives (see Fig. 7.1). The taxidermy is presented with interpretation that is short, playful and narrative based. It is written in the first person as if the animal is speaking and is intended to combine a slight anthropomorphism with some information about the living animal. This may encourage personification of the specimens, which Ash has found to be a potentially 'powerful tool for understanding and organizing novel material' in very young children (Ash 2004, p. 95). An example of the text is given below:

> **I am a pet rabbit**. I live in a hutch rather than digging a burrow under the ground like wild rabbits do. How else do you think I am different to wild rabbits?

This life-like voice emphasises the life-like quality of the taxidermy. This is accentuated by choosing specimens that are familiar to children, in good condition and often presented in dynamic poses. As previously noted however, the life and death qualities are so closely linked that this may in turn further emphasise the fact

Fig. 7.1 Taxidermy display in the Mini Museum at Birmingham Museum and Art Gallery ©Birmingham Museums Trust

that it is not alive. This rabbit does not "live in a hutch" but stays in this case. This was a deliberate approach to prompt adults and children to read the labels together and use them as starting points for conversation that could include story-telling or discussion of what taxidermy is. A simple description of taxidermy is included to help adults have this conversation with their children:

What Is Taxidermy? Taxidermy is a way of preserving dead animals in a life-like pose by mounting or stuffing the skin. All the taxidermy in this gallery was created over 50 years ago.

Here the visitors are encouraged to form a connection with the animal on display. This could serve to engage the family in conversation about the potential history of the animal's life. In contrast, those who are able to form such connections may feel less inclined to discuss lifelessness in that context.

Birmingham Museums also displays taxidermy at the Museum Collections Centre (Fig. 7.2), a museum store where open storage makes the profusion of museum collections visible to the public on monthly open days. The experience of taxidermy here is at the other end of the display spectrum from the carefully chosen, mediated and brightly lit examples in the Mini Museum. Visitors often seem to be particularly affected by the sheer scale of natural history collections behind the scenes. Aisles of birds without any mediation feel very different to seeing a few carefully chosen examples. Visitors are able to compare many taxidermy specimens of the same species but in different taxidermy styles and conditions side by side.

Fig. 7.2 Dead birds in Birmingham's Museum Collections Centre, including both taxidermy and study skins. ©Birmingham Museums Trust

These comparisons can simultaneously highlight the individuality of the original animal and of the artifice that created it, although these can also be difficult to separate. For example, the same bird species may have varying size, plumage and posture. The beak and feet may be painted in different shades and the glass eyes may be different sizes and colours. Realising that different eyes have been chosen creates a 'small tear in the fabric of the believable' (Gregory and Purdy 2015, p. 82). Snæbjörnsdóttir and Wilson's *nanoq: flat out and bluesome* art exhibition that toured between 2006 and 2009 in the UK assembled 33 taxidermy polar bears with diverse histories and appearances in one space to create a similar effect as that achieved organically, and repeatedly, throughout the museum store (Robin 2009).

The strong overhead lighting in the Museum Collections Centre creates deep shadows and groups of visitors often walk around listening to their own echoing footsteps. Visitors often seem stunned, and initial responses range from awe to fascination to distress. There are a number of potential emotional triggers in this type of display. The room itself may feel scary for young children and, coupled with the presence of dead animals, there could be an overwhelming sense of discomfort leading to avoidance of the store altogether. On the other hand, given the lack of direct connection to the dead animals, families may feel more able to broach the topic of life and death here in comparison with an area in which there is greater emotional connection to the animal itself.

These examples demonstrate that both intense engagement with an individual taxidermy specimen and being surrounded by an overwhelming, unmediated profusion of them can provoke strong reactions and potentially stimulate reflections on life and death. The response of families in the somewhat 'safe' environment of the Mini Museum compared to the Museum Collections Centre would provide an interesting case for further empirical investigation.

7.4.2 Case Study 2: Human and Child Skeleton Horniman Museum, London, UK

In choosing the following two examples from The Horniman Museum we are interested in bringing together 'degrees of deadness' (Poliquin 2008; Baker 2014), along with the potential effects on museum visitors of 'evocative juxtaposition' (Gregory and Purdy 2015). In addition, we wish to highlight the social complexity of displays, which appear to straddle an aesthetic border, situated somewhere between exhibits perceived as 'grotesque' and exhibits perceived as 'biological'.

In being stripped of their skin, the human adult and child skeletons (Fig. 7.3) afford a different version of 'lifelessness' and, as such, might attract more explicit biological references than animals with fur. However, culturally, human skeletons are often associated with death as a life-course event and in remembrance rituals (Wellcome Collection 2012) and, thus, they could be seen in the context of death as finality, and thus 'deader' than some of the adjacent taxidermic displays appearing

Fig. 7.3 Skeleton adult and child. Photograph Freya Macdonald-Osborne. Permission Horniman Museum and Gardens

to cultivate an 'aesthetic of liveliness' (Burt 2008). The concept of 'anti-taxidermy' might also be relevant to such discussions, 'as Desmond argues, the plastinated corpses of Gunther von Hagen's hugely popular *Body Worlds* exhibition are acceptable to a mass public precisely because they function as a form of anti-taxidermy, removing the skins to show only the anatomical details beneath' (Desmond in Gregory and Purdy 2015, p. 88). Thus, we suggest, it appears that skin is always perceived as personal, and individual, whereas internal organs and skeletal structure might be perceived as universal and considered to be less emotionally confronting. This particular specimen, with its skeletal surface geographies, might increase visitor attentional distance – 'the degree to which the observer attends or focuses on an object' (Patchett and Foster 2008; Schonmann 2006, p. 66). However, due to the human subject matter of adult and child, emotional distance – 'the level of response that an observer maintains towards an object' might decrease. Furthermore, we suggest that the lifelessness of this exhibit is visually highlighted by contrast with the life-likeness of the surrounding taxidermy. Thus, we consider such exhibits could be provocative for conversations about life and death. No less so when their human subjects might be 'provocatively intimate' (Poliquin 2012, p. 39) and yet distant due to their skinless, skeletal state.

7.4.3 *Case Study 3: Dead Dog Heads Horniman Museum, London, UK*

As noted earlier, there are perceived degrees of deadness with 'just heads' being perceived as appearing distinctly 'deader' (Baker 2014; Poliquin 2008;). The dog-head display in the Horniman Museum (Figs. 7.4 and 7.5) presents a scientific narrative (theory of evolution) demonstrated by a case study - from wolf to dog - in a cultural context; pet dog breeds. When thinking about the potential for emotional connection, this type of display would seem to offer at least two reasons for perhaps inciting more emotion than would some other taxidermy exhibits. First, the potential for families to relate the dog breeds to a familiar pet, or even just dogs that are known to them, might create a sense of discomfort with the content of the display. Second, the fact that only the heads are presented could seem somehow grotesque, creating a sense of disgust or aversion. In terms of engagement with the concepts of life and death, this type of display might result in families avoiding the area altogether or, for those willing to brave the topic, a deep engagement with the dogs' dismembered state of lifelessness. From what we know about discussions about death from previous studies (Gutierrez et al. 2014) it appears that, when the emotional tie is tighter, there seems to be less inclination to discuss death. Our knowledge concerning displays perceived as 'grotesque' is, however, much less informed and remains an understudied area.

Potential for Further Research Among Visitors and Developments in Curatorial Practice The reflections on how visitors experience life and lifelessness through

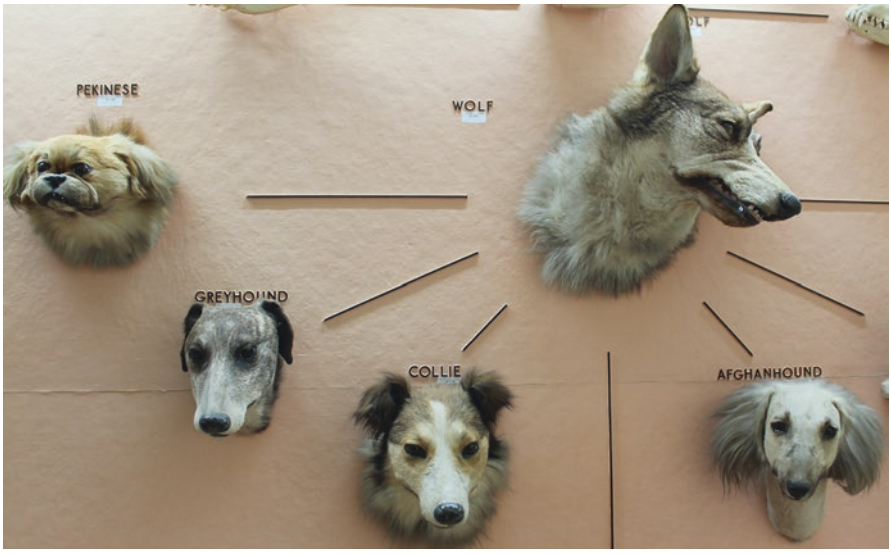

Fig. 7.4 Evolution Display Wolf and Dogs, Horniman Museum and Gardens. (Photograph Freya Macdonald-Osborne. Permission Horniman Museum and Gardens)

Fig. 7.5 Evolution Display Wolf, Horniman Museum and Gardens. (Photograph Freya Macdonald-Osborne. Permission Horniman Museum and Gardens)

taxidermy in this article are theoretical and sometimes speculative. The nature of this topic makes visitor research challenging as it involves implicit learning, presence effects and experiential narratives, which are spontaneous, emotional, and difficult to identify and quantify (Bencard 2014, p. 39; Elwick 2015, p. 420; Poliquin 2008, p. 130). Compounding this, young children's learning about death through taxidermy is of particular interest and is particularly challenging to research (Kirk 2013, p. 1).

Despite these challenges, we believe that there are avenues for expanding visitor studies in this area. Elwick has shown how close analysis of interviews with a particular awareness of self-contradiction may be one way of detecting implicit learning among adult museum visitors (Elwick 2015). This may also be a potential starting point for assessing feelings and knowledge about taxidermy. We could also use archival records such as diaries, visitor books and correspondence to study, 'not only the external but also the internal history of visiting' in museums, including the response to taxidermy (Alberti 2005, p. 570). As demonstrated through Case Study 4, visitor service assistants are also a huge and largely untapped resource for information about how our visitors respond to taxidermy every day.

Kirk, among others, has demonstrated how photography can be a useful tool for studying the experience of very young children in museums (Kirk 2013). She gave participating groups with four and five year olds a camera and asked children to take photographs of the objects that interested them in the Oxford University Museum of Natural History. After their visit, she used the photographs as a starting point for a conversation with the children about their visit. This methodology could be used to approach how children focus on and talk about taxidermy in different setting such as traditional galleries, children's galleries and behind the scenes tours.

It is also possible to focus on the conversations between parents and young children during their visits to a natural history gallery. There is now a substantial body of research examining parent-child conversations about science in museum settings (e.g., Crowley et al. 2001; Crowley and Jacobs 2002; Fender and Crowley 2007; Hohenstein et al. 2015). The findings of these studies suggest that parents provide useful ways of focusing children's attention of the material presented in science exhibits, through explanations (Crowley et al. 2001; Fender and Crowley 2007), asking questions (Ash 2004; Hohenstein et al. 2015), providing analogies (Valle and Callanan 2006) and other mechanisms. By studying the ways that parents and children interact in taxidermy settings, with a particular focus on conversations about life, death, and the representation in taxidermy, research may be able to gain insight into the ways that children think about these subjects as well as ways that parents deal with children's curiosity towards them.

Curators need to 'find ways of approaching the complex and uncertain objects that fascinate because they literally hit us or exert a pull on us' (Stewart in Bencard 2014, p. 30). This is never truer than it is for taxidermy. Such complexity goes beyond display techniques and also includes consideration of social interaction and visitor experience as a whole, which is the focus of Case Study 4.

7.4.4 Case Study 4: Increasing Staff and Visitor Engagement with Taxidermy at Thinktank Science Museum

Thinktank Science Museum is another site within Birmingham Museums Trust that displays taxidermy. Here an assortment of specimens is displayed with minimal scientific labelling in a 'Biodiversity Showcase'. A project in 2016 involved the curator (one of the authors, Meehitiya) working with Visitor Services Assistant Helen Roberts to share insights into the taxidermy and increase the knowledge and confidence of staff in interacting with visitors around the taxidermy. We know that visitors rarely read labels, whereas there is huge educational potential in enabling museum educators to help families and children form narratives around taxidermy (Reiss and Tunnicliffe 2011). We shared experiences based on interactions with visitors and literature about taxidermy and toured the taxidermy in the Museum Collections Centre together. We considered taxidermy from a wide range of perspectives, covering the construction, conservation and research uses of taxidermy and discussing the history and visitor response to this collection. Roberts used this experience to create a written guide and training for the front of house team on using taxidermy with visitors and answering their questions, and prepared a new tour for visitors about taxidermy. As a result of the project Helen became not only the 'go to' expert on taxidermy but also more reflective about its more subtle and emotional effects on visitors of all ages:

> It made me much more aware of their reactions. I was actually looking for their reactions and thinking about how to deal with their reactions. (Helen Roberts, personal communication, Jan 8 2015)

Curators are part of a movement to advocate ever more effectively for the potential of taxidermy to aid scientific research, learning and creativity (see for example Bradley et al. 2014; Cook et al. 2014; McGhie 2015a, b; Rocha et al. 2014). Beyond this, they are also demonstrating an increasing willingness to 'answer the types of questions visitors ask about museum taxidermy' (Andrews 2012, p. 61). These questions range from taxidermy techniques to 'the colonial provenance of many specimens (Lougney 2005), or the ethics of killing animals to collect them (Smith 2007)' (cited in Andrews 2012, p. 61). However, there is still a level of awareness and responsiveness to our visitors that goes beyond this and that includes awareness of potentially deep emotional impact and even deeper questions of life and death. We must also embrace the fact that museum visitors, especially when experiencing taxidermy, 'will be emotionally and intellectually stimulated in ways that we can never know' (Kirk 2013, p. 43). Similarly, whatever our curatorial practice much of their experience will always come 'from within the visitor – things remembered and felt.' (Alberti 2005, p. 569).

7.5 Conclusion

Taxidermy is liminal. It has strange effects on people. These effects are influenced by taxidermy itself, display techniques and the memories, knowledge, experience and conversations that individual visitors, both adult and child, bring to the museum. Ultimately, there would seem to be a great opportunity for families to engage with the topics of life, living and lifelessness whilst viewing taxidermy displays. These displays provide safe environments to observe real animals up close whilst instilling questions about how they came to be in the cabinets and cases in which they reside. Of course, they may also reinforce a fear of discussing death and dying, even though there would appear to be a greater emotional distance for taxidermy in comparison with family pets and human relatives. Researching this proves challenging because of the intangible and unconscious nature of reactions to concepts of life and death; but there are research avenues available to study. Case studies in natural history museums offer researchers and curators opportunities to examine the affordances of taxidermy for learning about life and death. As discussed in this chapter, the ways in which such displays are constructed and presented might facilitate diverse responses among visiting family groups. Thus, by knowing more about such responses, we can offer museum curators a research-based perspective on the impacts of taxidermy and, we hope, influence the future use of such enigmatic specimens.

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Chapter 8
Cultural Conflict: The Stories Dioramas Tell and Don't Tell

Doris Ash

> Debates over who is authorized to speak for whom, and about what, have created a sometimes disquieting and sometimes exhilarating dialogue over the politics of representation. One person's lexicon of translation and analysis may be another person's lexicon of anguish. (Dubin 2010, p. 479)

8.1 Introduction

This chapter treats dioramas somewhat differently than do the other chapters in this book. As in other chapters, we begin with the benefits of dioramas—their value to learning and teaching, and other advantages they offer. We go on, however, to address some problematic aspects of dioramas: their power to represent cultural conflict and their historical misrepresentation of cultural realities.

I have been interested in natural history dioramas throughout my life. As a biologist and science educator, I fell in love with dioramas as a young girl in New York City, repeatedly visiting the American Museum of Natural History (AMNH). Growing up, I visited museums and was comfortable with the reality they presented and their prompts to tell myself stories, which encouraged me to lose myself in their landscapes and the imaginal realms I might never see in real life. I still enjoy them today.

Since their origins as 'cabinets of curiosity,' dioramas have occupied a noble place in natural history studies. They inform people of things they would otherwise never see; they foster conservation, civic mindedness, pride, and other values; and they provide insights into new dimensions and imaginings. Dioramas are designed

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to spark your imagination and help you think in different ways, and to represent new and/or unfamiliar realities.

> …[for] at least one brief moment you "see through" (the root meaning of the word diorama), as though you were actually there, directly witnessing an event or a moment that could have, really could have, existed somewhere in the real world. (McPhee. In Diep, 2012)

At the American Museum of Natural History, for example, dioramas were created to make people become aware of, and develop a wish to protect, wildlife in general and vanishing species and habitats in particular. Dioramas seem like an excellent medium for telling stories and revealing aspects of nature not readily available to the ordinary citizen. Kutner said this of dioramas in natural history museums:

> Dioramas arose in the late 1800s, largely out of a desire to return to nature following the Industrial Revolution. "These are what you might call the earliest version of virtual reality," says Stephen Quinn... long-time diorama artist at the AMNH. The displays consist of taxidermied animals, foreground props and artfully painted panoramic backgrounds. More than just works of art, dioramas are true to science; for decades, artists and scientists went into the field to collect specimens and their surroundings and replicate them exactly as they appeared. (2015)

This is the wonder and beauty of natural history museums, whose role has for centuries ranged from preservation and conservation to education, advertisement and outreach. Their job was to save and preserve, collect and maintain. As Thompson (2005) has explained:

> The hey-day of collecting was probably the Victorian age, when collectors fanned out across the globe, risking life and limb, usually without much regard to the sensibilities of the country and people involved, to bring back literally everything they could find. Such blanket collecting—taking the common with the rare, and a few of each species, instead of carefully targeted, statistically valid sampling—is unfashionable now.

Yet, while natural history museums focused primarily on collection, native habitats, biomes, endangered species, conservation and similar concerns, they also included cultural exhibits that portrayed so-called 'primitive,' indigenous, or enslaved peoples and their artifacts.

When the goal is conservation, either of near-extinct species or habitats, there appears to be a double goal of not only allowing the public to witness what they might otherwise never see in real life, but also advocating for the conservation of the exhibited entity. This double goal seemingly works well for endangered species and habitats, but is problematic when applied to indigenous peoples.

Many museums have endeavored to catch up with new cultural norms, but there is no consensus about how to appropriately portray indigenous or enslaved people. Similarly, for the South African Bushmen, there was a perceived need for "collecting the remnants of the 'vanishing race. As Indians were hunted, forcibly moved, or educated in special schools across the United States, there was fear that their 'cultural objects' would disappear. Then, the race was on to collect artifacts before it was too late (Dubin 2007). Hence, the title of this chapter refers to the current challenges regarding what to represent in dioramas.

8.2 Contested Realities: Racism and Cultural Hegemony

Indigenous knowledge systems worldwide generally embody a more holistic understanding of the natural world than do Western scientific knowledge systems… Indigenous perspectives, however, have been highly marginalized among scientific communities and are infrequently addressed (Tolbert 2015, p. 5).

I use the above quote to situate the ways in which indigenous knowledge has been minoritized in schools and in museums (Ash in preparation; Aikenhead and Michell 2011; Chinn 2007).

It is fitting to highlight this current tension/conflict within natural history museums that calls into question the perceived value of indigenous artifacts and by proxy their knowledge systems. This tension is engendered in many ways but one of the most obvious is the juxtaposition of indigenous cultural and human remains with traditional natural history dioramas. Such placement leaves the impression that indigenous people are animalistic, or perhaps that primitive cultures are similar to animal cultures. This sentiment is captured in the quote below:

> Natural history museums…house amazing dinosaur fossils, exotic hissing cockroaches, and wondrous planetariums—right next to priceless human-designed art and artifacts created by Native peoples of the Americas. Like me, you might wonder why these designed objects are juxtaposed with objects of nature such as redwood trees and precious metal exhibits… (Hadal 2013)

Many hold the worldview that such intermixing of animal and human remains and artifacts is 'normal'. For others, this is sacrilege (Lonetree 2012). Viewing humanity as a hierarchical sorting, with white at the top and people of colour at the bottom, is a historical phenomenon (Kendi 2016), which in the United States predates slavery, and which exists across the world where colour, religion, language, wealth or other similar divisive factors prevail. We have seen the practical outcome of such conflict in racist historical and contemporary representations of African-Americans, Native Americans, and South African Bushmen who are often represented as less human than whites, in museums. Such racist views have been reflected in the three case studies of dioramas we will discuss.

Indigenous people portrayed in such insensitive ways have long contested how their ways of life, spirituality, and art have been represented (Dartt-Newton 2009; Lonetree 2009). They argue that the 'less than' status, that is projected on them, conveys dominant power and hegemony, past colonialism, racism and deficit ideology (Gorski 2010). Indigenous peoples ask museums to transform such worldviews arising from Western European-American colonialism (Lonetree and Cobb 2008). This may not be simple to achieve as any entrenchment of power is difficult to change. Conflict inevitably comes up against issues of power, hegemony, colonialism, and ownership (Dubin 2009).

8.3 Three Case Studies of Cultural Conflict within Dioramas

Here, we review three specific examples of diorama conflicts: two indigenous cultures—the Native Americans and South African Bushmen—as well as a less widely acknowledged controversy regarding the portrayal of African Americans. These controversies have been continuous, contentious, and informative. In each, first I examine the physical appearance of the diorama and its implied message, and then explore the particular perspective used in its design. These perspectives influence, if not determine, the message or story of each diorama.

The messages conveyed by dioramas of Native Americans, African Americans, and South African Bushmen, whether focused on science, anthropology, culture or archaeology, were typically authored by their designers, collectors, and curators, typically not with the indigenous peoples or African-Americans. Dioramas depicting indigenous or enslaved people were originally designed to convey selected aspects of past or present cultures; typically containing models of actual people, everyday objects, such as pottery or shoes, and a background meant to capture a particular moment in history. The messages imparted by such depictions have been both implicit and explicit, and they may or may not be culturally sensitive towards their subjects. They may be old messages that have been passed along from earlier decades, without any attempt to revise their effect. As Diep (2014) suggests "These beautiful, 50- or 100-year-old dioramas are a holdover—and a subconscious reminder—of some of the worst moments in U.S. history."

Some stories are partially printed on signs and labels, told by docents, or by audio recordings or videos. Others are more implicit or suggestive, using placement selection of particular objects and mementos as cues. Those creating dioramas strive to have everyday visitors (mostly white, middle class, and of European ancestry) get in touch with phenomena they can no longer experience. Often the depictions are of situations or people that may soon disappear or are already gone. Some depictions are often overly romanticized or nostalgic; others are brutally honest.

Older cultural dioramas often conveyed messages tending to portray seemingly 'content' people frozen in a historical moment in time, but also 'less than advanced' modern culture. This message was grounded in the perspective of the European-American, typically upper-class white explorers and collectors who bought, stole, arranged, and interpreted the things they saw. In the United States, these views have often echoed larger master narratives, such as the heroic conquest of the west, the civilization of primitive people, and the overcoming of numerous obstacles to obtain nationhood, statehood, and especially, to obtain and keep land as property.

Many important details, such as rape, pillage, rampant disease, and forced religious conversions were omitted from these heroic messages (Lonetree and Cobb 2008). These brutal facts certainly pertain to the histories of the American Indian, African Bushmen, and African American, but are rarely depicted in dioramas. The omission of such essential facts is most likely rooted in the effort to avoid difficult topics, the tendency to retell history according to colonialist European American norms, and in the perceived inevitability of collateral damage to other cultures in the name of 'progress'.

While these dioramas rarely related messages from the perspective of the native indigenous cultures being portrayed, this is now changing. It has only been in the last few decades that indigenous peoples have begun to build their own museums, and to tell their own histories from their own social, cultural, and native experiences and perspectives. The Ziibiwing Center in Michigan is one example of a Native-American-designed and operated museum (see also Lonetree 2012). The Ziibiwing Center differs in its presentation from the standard cultural, social, archaeological, anthropological stories told by most museums, that is, from the Western European American perspective. We address the Ziibiwing Center in more detail later in this chapter.

8.4 Three Examples

In this next section, I discuss three examples and emphasize cultural contradiction, while also discussing the dominant perspective and what it means to take a perspective.

8.4.1 Example 1: African–Americans: The Old Folks at Home

> As early as the turn of the nineteenth century, popular "museums" had proven the immense appeal of their wax models and painted illusions. (Brundage 2003, p. 1381)

Figure 8.1 shows a picture titled 'Old Folks at Home'. One might assume from this rendering that slavery (The Peculiar Institution, Stampp 1956) and/or any false characterization of the African-American slave is part of a benign and paternalistic tradition, and one that is done for the slaves' good. In fact, slavery was a toilsome and dehumanizing way of life, and one that African-American slaves actively resisted (Stampp 1956). The art piece in Fig. 8.1, a 4 × 5 in. color transparency, is housed in the State Archives of Florida in the folk-life section. There is no information on the exact time it was meant to represent.

This representation, even though not in a natural history museum, serves as an example of the portrayal of enslaved African Americans as contented citizens at peace with the world. It portrays neither the past or present reality, but it does reflect the way many white European-American landowners perceived (or wanted to perceive) the lives of their slaves (Kendi 2016).

The diorama in Fig. 8.2 (and others like it) was created around 1820 by Gerrit Schouten, a Dutch government clerk, and was designed to be sold as a souvenir to show the 'bucolic' life of dancing slaves (Byrne 2014).

Let's compare the dioramas in Figs. 8.1 and 8.2 with the following use of dioramas, as described by Brundage (2003), who recounted Meta Warrick's creation of the Tableaux of the African-American experience at the Jamestown Tercentennial Exposition in 1907.

Fig. 8.1 Photograph of an African American diorama, Old Folks at Home, State Archives of Florida

Fig. 8.2 Diorama of a slave dance, Gerrit Schouten

Confronting visitors, who meandered through the Negro Building at the 1907 Jamestown Tercentennial Exposition, held in Norfolk, Virginia, was a tableau entitled *Landing of First Twenty Slaves at Jamestown.* Meta Warrick (Fuller), a sculptor, had created and arranged twenty-four two-foot-high plaster figures that re-imagined the shackled, nearly nude, and traumatized Africans who had landed in Jamestown in 1619. In *Landing* and thirteen other dioramas, she used more than 130 painted plaster figures, model landscapes, and backgrounds to give viewers a chronological survey of the African American experience. Scenes ranged from a tableau of a fugitive slave to a depiction of the home life of "the modern, successfully educated, and progressive Negro." (Jackson and Davis 1908, p. 195).

Warrick's dioramas were deliberately designed to give an accurate account of African-American life to the public, but especially to the African Americans who might see them. Warrick, who trained in Paris, was a 'negro aristocrat' from Philadelphia; she wanted to provide accurate information to other African Americans. As Brundage suggested, Warrick's depictions showed the upward evolution of African Americans, from slavery to modern times, to "provide evidence of the modernity of African Americans to whites and blacks alike" (Brundage 2003, p. 1370).

As Brundage noted: "Whereas 'Old South' dioramas and such related anthropological exhibits organized by whites (such as Figs. 8.1 and 8.2) *exhibited* blacks, Warrick's dioramas *represented* them" (p. 1373). The distinction between *exhibiting* and *representing* Blacks was not just about authorship, but also about identity, agency, defining cultural norms, and re-interpreting colonialist histories. Warrick took the opportunity "to destabilize the binary classifications of civilization and 'the other,' and of modernity and primitiveness" (2003, p. 1371).

Warrick's alternative view went against the mainstream perspective and demanded that we look at African-American history openly and honestly. Unfortunately, these 1907 dioramas no longer physically exist; there are only written accounts by contemporaries. However, newer museums, such as the Museum of the African Diaspora, which showcases the art, history, and cultural richness that resulted from the migration of people of African descent, are designed to represent Blacks in historically accurate ways including the traumatization and ongoing suffering of the lived experience of slaves.

8.4.2 Example 2: South African Bushmen

> As a general principle, culture wars are more likely to break out at times when there is a high degree of communal fragmentation and polarization, and widespread civic malaise and low communal morale. (Dubin 1992/2014, p. 38)

Not surprisingly, there are similar contradictions in the representation of the indigenous people of South Africa. Figure 8.3 is a museum depiction of South African Bushmen. These models were made in the 1900s by museum modeler James Drury, who, when it was thought that the Bushmen might be dying out,

Fig. 8.3 A young visitor studies a Bushmen exhibit, Gideon Mendel. Getty Image

made casts of living people (a long and painful process). Even though the people who were cast actually wore modern clothes in their daily lives, they were represented in the cast figures as almost naked and displayed in past contexts and styles of dress, in order to preserve them for posterity (Davison 1993, 2005). The sixty-eight body casts of Bushmen specimens were taken in a process that was both humiliating and painful for the participants. The title of Drury's book, *Bushman, whale and dinosaur*, detailing his 40-year affiliation with the South African Museum, gives some indication of the status these human specimens were granted in relation to animals.

Not surprisingly, these casts have been the source of great controversy and complex interactions between museums, the public, and the Bushmen, who are more accurately referred to as the San and Khoi indigenous groups. The casts were originally displayed with little contextualization or reference to the Bushmen's complex social and cultural networks, and the Bushmen were typically referred to in the past tense. In the late 1950s, the Bushmen models were re-situated into an 'invented cultural context,' with new labels and narratives that were based on an early nineteenth-century painting by Samuel Daniell. This newer narrative also emphasized probable extinction and lacked accurate historical contextualization (Coombes 2003).

As with the African Americans in the US, the sanctioned perspective is that of white European-American curators, anthropologists, modelers, and/or museum directors, in the service of *exhibiting* Bushmen rather than *representing* them.

Several subsequent shifts in the exhibition have occurred at this museum, now called the Iziko South African Museum. In 1989, a companion exhibition was

created to provide context and background of the people who had been cast in the exhibit (Dubin 2006). And in 1993, an exhibition called 'Out of Touch' used "dilemma labels" and superimposed images to "qualify previous notions of cultural stasis by acknowledging urbanization and other changes" (Rankin and Hamilton 1999).

To complicate matters further, two different museums were vying for the right to represent the Bushmen in the 1990s, each asking the question, 'who are the Bushmen?'

The South African Museum (SAM) and the South African National Gallery, situated across from each other … [reflected a] debate regarding how the indigenous categories, 'Bushman' and 'Khoisan', can be publicly represented (From Jackson and Robbins 1999 in Dubin 2007).

Dubin discussed the role of the SAM further, stating:

> Negative voices have intensified in recent years. SAM personnel responded by incorporating this dissent into the display itself: the museum posted text that summarized contemporary debates so that viewers could understand the variety of reactions that the diorama evoked. SAM supplemented this by displaying copies of news articles, information concerning the making of the casts, as well as providing a social history of the people who were depicted. Until 2001, this approach created the sense of a continuing discussion … But then SAM shut down the diorama in April of that year… (Dubin 2006, p. 487)

Across the street, in 1996, the newer exhibit, *Miscast,* at the National Gallery art museum, reinterpreted the Bushmen as being fundamental to South African culture. *Miscast* was designed to counteract the disparaging treatment of The SAM. As Dubin suggests, *Miscast* also raised conflict:

> *Miscast* was dynamic: it incorporated multiple perspectives, involved a variety of media and sensory experiences, and required the audience to interact with its various components… the [original] diorama disregarded the reprehensible treatment accorded the Bushmen by European settlers and their descendants – it was legal to hunt and kill them well into the twentieth century (see Gordon 1992) – *Miscast* interrogated that history. And, significantly, *Miscast* was presented in the National (Art) Gallery, … thus troubling entrenched notions of where nature and culture "belong." (p. 499)

The *Miscast: Negotiating the Presence of Khoi and San History and Material Culture* exhibition was designed by someone of European descent and some of the elements were considered to be derogatory, "thus troubling entrenched notions of where nature and culture "belong."' (Dubin 2006). Some Khoisan argued that the exhibition designer could not speak about or for their people and that there had been 'inadequate consultative protocols' developed with representatives (Dubin 2007, p. 488). In short, it failed to accurately represent them. Subsequent exhibitions have attempted to incorporate quotes from Bushmen individuals and installed a replica cave to "allow the viewer to experience something approximating what the Bushmen might have felt originally" in answer to the deficiencies of past Bushmen displays (Dubin 2006, p. 489).

The exhibits and the controversy they engendered have been written about extensively in museum literature by Drury, Dubin, and Coombs, who used it as a

basis for exploring how hegemony, power, and culture affect modern museums that attempt to deal with their country's colonial past and the objects they had collected and made.

The issue of perspective is critical. Whose perspective is being used and toward what end? Similar to the African American controversy described above, the Khoisan people were *exhibited* by others, rather than *represented* in their own voices. There was no Meta Warrick to accurately represent their history, culture, or spirituality.

8.4.3 Example 3: American Indians Behind Glass

> We wanted to stay away from the whole idea of Indians behind glass… (Diep 2014)

By 'American Indians behind glass', Diep means American Indian mannequins and dioramas with a wall of glass separating them from museum visitors to keep people out and to protect the exhibits. The two quotes below tell very different stories of the diorama experience:

> They force one to look closely, especially in miniature, imagine an entire village scene in 100 cubic inches." (Diep 2014, quoting Raymond Silverman, director of museum studies at the University of Michigan).

And the opposite view:

> Dioramas only serve to confuse the public and enforce already present stereotypes… Dioramas can muddy the experience by placing a contemporary interpretation of a life that we do not have firsthand knowledge of. (Diep 2014)

Because such miniaturized dioramas depict a culture in a freeze-frame moment in time—often during the seventeenth century, when many tribes first came into contact with Europeans—the dioramas encourage viewers to think that all American Indians still live as depicted in the dioramas. They are static rather than dynamic, and don't to give a sense of depth, time or dimension. As one Native American expresses it:

> We are living, breathing, contemporary human beings. Many of us felt it was wrong that we had been represented so long as little dolls in the context of a natural history museum. (Margaret Noori quote, in Diep 2014)

Complaints like these have resulted in the removal of some dioramas (Fig. 8.4) (Miller 2015). One of the more interesting cases occurred at the University of Michigan museum. Part of this conflict is excerpted below to convey the flavor of the interactions at the time (Capriccioso 2009).

> They showed eight indigenous cultures of North America, of which six were from the Michigan area. Four of the Michigan tribes were represented as they would have looked at colonial contact, and two depicted more ancient times.
>
> Museum officials said the dioramas have been popular throughout the years, especially with elementary school children and teachers who regularly visit the site for a field trip learning experience.
>
> Tiya Miles, director of the Native American Studies Program at the university, first encountered the dioramas in 2006, a few years after she moved to Ann Arbor.
>
> "Through the placement of the dioramas in the natural history museum setting, a de facto relationship seemed to be posed between animals, inanimate objects, and indigenous people."
>
> Her initial critical impression has only grown stronger as she's heard stories about the negative experiences of Native American children who view the dioramas in the company of non-Native children, such as on elementary school field trips.
>
> "Small children who have no other means of learning about Native histories and cultural ways sometimes highlight details (such as a lack of full dress of the figures) that are anachronistic in our modern times, and tease Native children about them," Miles said.
>
> "This kind of exchange is detrimental to Native students' identities and all students' learning."

Sometimes there was conflict over the size of the mannequins, actual size verses miniaturization but this is not the main concern. Diep (2014) argues that the problem is deeper than size. These disagreements arise because dioramas, in and of themselves, are not 'the problem'. The real 'problem' is the culture that put American Indians in dioramas in the first place—in natural history museums…in these sometimes-beautiful, contained worlds meant to record what the assumed viewer's ancestors had wiped out (p. 47). This fundamental tension always exists for the viewer, whether it is appreciated or not.

An example of a countermeasure being taken to the *exhibition* of American Indians is their decision to *represent* themselves in their own museums and dioramas. Amy Lonetree (2012) has written of several new museums that are deeply influenced by American Indian peoples' spirituality, culture, and history, and that tell their stories differently. Several modern Indian museums, designed and maintained by tribes themselves, have grappled with how to more accurately represent their experiences in the form of dioramas. One of the most interesting exemplars, the Zipiiwing Center in Michigan (Fig. 8.5), by the Anishinabe, "discussed dioramas extensively before they opened in 2004" (Diep 2014).

Fig. 8.4 Dioramas at the University of Michigan

Fig. 8.5 Diorama at the Ziibiwing Center in Michigan

The Ziibiwing decided to represent their culture as follows:

> They settled instead on more open displays, populated with life-sized mannequins that can be updated as Anishinabe culture changes. The displays are spread along the sides of the main, curving pathway where visitors walk. They show pre-contact Anishinabe people and Anishinabe activities through the seasons. Photographs and artifacts show the colonization of Anishinabe land by white Americans, while modern Anishinabe-made artwork show the tribe's current culture. None of the mannequins are inside glass cases. "We wanted to stay away from the whole idea of Indians behind glass," says Martin, the center's director. (Diep 2014)

The Ziibiwing Center uses oral history as its center-piece, and relies on seven prophesies to underpin its master narrative. The central themes include:

1. Written in stone (wisdom in stone, petroglyphs)
2. Teaching lodge (spiritual, lifelong learning)
3. The laws/rules made by the government (U.S. policies)
4. When the promises were made (how a treaty may have looked)
5. Great illness and death (result of US government policies)
6. Blood memory (the inherent connection to spirituality, ancestors, and all of Creation);
7. Reburial of the Anishinabe of long ago (ancestors have the right to remain undisturbed in the earth)

The differences between the Ziibiwing Center and other museums arise from the desire of Ziibiwing museum staff to "put American Indian survival in a colonial context, directly challenging the classic western narrative of American Indian disappearance after westward expansion" (Lonetree 2009, p. 137). The Ziibiwing Center presents uncomfortable issues such as "diseases, killing, land theft, poverty, violence, and forced conversion by Christian missionaries" (p. 134). They actively promote the native Anishinabe language and raise awareness of the days of boarding school "traumas," especially the experience of American Indian children being forced from their homes, forced to speak only English, and forced to adopt Western ways" (p. 145).

The Ziibiwing Center *represents* American Indians from the Native perspective rather than *exhibiting* them from the European-American perspective.

8.5 Discussion

> With the end of colonialism, the rise of new nationalisms, the official recognition of and respect for ethnic diversities, and increased local pride in local art, traditions, and knowledge production, the "culture" of museums has had to change. Ironically, it has been the culture of the colonial, not of the indigenous people to pass away. (Thomas 1993, in Macleod 1998)

Competing points of view—that dioramas are a place of wonder and imagination vs. dioramas are a place of shame and dishonesty—make visible the significant cultural conflicts that rock our modern world.

Disagreement about the way indigenous peoples are represented is not new (Dubin 2007), and these disagreements concern not only indigenous or enslaved peoples. The three cultural conflict examples used here stem from dioramas or depictions that have already been contested, modified, and/or removed. These examples are taken from different peoples of various cultures, languages, and social systems, but who share the experience of having their cultural realities misrepresented.

We now understand that displaying American Indian cultures alongside dinosaur fossils, gemstones, and taxidermied animals portrays American Indians as less than fully human. Living South African Bushmen were cast in plaster, placed in incorrect contexts, and also treated as less than human. African Americans were frozen in time, reifying a fantasy vision of the enslaved rather than free modern people. And, because each was depicted in freeze-frame moments in time—often around the time of first contact with Europeans—each culture was historicized in incorrect ways. Often the story itself was antiquated, highly biased towards Western European cultural norms, and inaccurate. The identity, power, and agency of the subverted cultures were at stake. Times are changing.

Museums still reflect the colonialist perspectives in many ways, but they are reconsidering, revising, and 'reculturing' (Ash in preparation) their approaches. The closing of the Bushmen exhibits in South Africa, and the removal of the Native American representational exhibits in Michigan are good examples of how "curators and scholars are obliged to recognize that the museum 'is no longer, if ever it was, innocently engaged in the processes of collection, conservation, classification and display of objects'" (Silverstone in Macleod 1998, p. 308).

In the past, most museum exhibition narratives of the histories of Native Americans, African Americans, and South African Bushmen were controlled by museum curators and collectors, and interpreted by museum docents. These exhibitions and interpretations reflected the perspective of the collectors and the ethos of past centuries. Early collectors engaged in officially sanctioned collection parties, often without regard to the indigenous people's spiritual, cultural or personal values, in order, instead, to burnish the image of the museum, its benefactors, and its Board of Directors. This hundred-years old emphasis on collection still permeates museum culture; the valuable materials collected in past centuries continue to be interpreted from the Western-European perspective; and in many cases the colonial perspective remains essentially unchanged.

There have been counter perspectives and counter exhibits—the Warrick dioramas of 1906 (see Brundage 2003), the Ziibiwing Center in Michigan (see Lonetree and Cobb 2008), and even the *Miscast exhibit* in South Africa in 1996 (see Dubin 2006)—all of which have attempted to re-write the master narrative and refute the dominant colonialist perspective that has framed most museum dioramas depicting indigenous peoples.

8.5.1 The Fundamental Role of Cultural Conflict

Are dioramas objects of beauty to be admired, imagined, and dreamed? Are they crass cover-ups of some of the worst moments in history? Are they both? We have seen in the three examples how much social, cultural and historical perspective matters. Do we view indigenous cultures from a colonialist, heroic point of view, filled with self-satisfied European superiority, or from a post-colonialist viewpoint that emphasizes the enforced social, psychological, and cultural enslavement of indigenous peoples by our ancestor colonizers? This stark contrast is mirrored in the cultural conflict surrounding how to interpret dioramas.

The answer depends on the perspective of those doing the interpretation. One person may see an American Indian display as the 'spoils of war' while another may understand it as the portrayal of the 'real' culture. Who is correct?

Dubin has argued that dioramas can be positioned as sites of persuasion, and suggests, for example, that:

> Conflict and negotiation habitually occur at sites of persuasion such as museums, manifest in revival, or reawakening dormant beliefs and values; in reaffirmation, asserting the importance of particular principles and standards; in recommitment, directing energies toward communal goals; in reclamation, asserting ownership over objects or knowledge that has been forbidden or denied; in repatriation, procuring what was seized by outsiders in the past; in recuperation, reinscribing personal narratives that have been suppressed or erased; in resanctification, restoring what has been profaned; and in reconciliation, developing new relationships between the past, the present, and alternative visions of the future. (Dubin 2006, p. 478)

This very broad statement applies, at least in part, to the examples we have discussed in this chapter. Let's consider the places in which personal narratives can be 'reinscribed'.

One of the fundamental tensions we face in interpreting dioramas is the inescapable truth that most collectors attempted to rapidly gather together and save material goods, while often the national government tried to destroy the people who produced them. The American government, for example, strove to minimize, denigrate, and erase American Indian social, spiritual and material cultures, while museums were collecting and preserving behind glass the physical items associated with these cultures. We see this situation in the following quote: "the 1893 Columbian World Expo in Chicago included an American Indian village display to show visitors an "almost extinct civilization, if civilization it is to be called" (Diep 2014). The phrase "if civilization it is to be called" was the dominant attitude in the 1800s.

The same is true of the South African Bushmen exhibition, who were considered to be sub-human. The Khoisan were displayed as casts because it was anticipated that they would soon be extinct. At that time, it was still legal to hunt and kill South African Bushmen; and, there was little to no regard for their social, spiritual or material cultures. Despite their not becoming extinct, the casts, models, and artifacts endured as museum exhibits, as originally intended. While times had changed, the dioramas did not. Subsequent adaptations and new exhibits have demonstrated only incremental shifts in perspective.

African American slaves too, were frozen in time, reifying a vision of enslaved beings who were happy, yet less than human, rather than as a free modern people. The story most often told was antiquated, highly biased towards Western European cultural norms, and wildly inaccurate.

The identity, power, and agency of these subverted cultures were viewed as the property of the collectors, owner, or beholder rather than of the represented peoples. And as Warrick and Brundage noted earlier, marginalized people such as slaves were not allowed to *represent* themselves instead they were *exhibited* by others.

Gurian (2006), Jackson and Robbins (1999), Dubin (1992/2014, 2006, 2007), Hooper-Greenhill (1992, 1994), Macdonald (2006), Dawson (2014), myself (Ash in preparation) and many others have written about power and hegemony in museums. This is not a comfortable or easy topic to address.

We currently are participating in an ongoing international dialogue, which reflects the transitional times in which we live. As indigenous peoples increasingly represent themselves, as post-colonialist perspectives take hold, and as hard truths are told, we can hope that an accurate reflection and explication of the conflicts will help museums and indigenous peoples to (as Dubin suggested) reinterpret, recuperate, repatriate, reclaim, reaffirm, recommit, and resanctify, while we direct our energies toward communal goals and reinscribing new meaning to old, and very tired, perspectives.

8.6 Conclusion

We are caught in an interesting moment in history. A decade from now we will probably look back at this transitional time and notice the shifts in how we recognize and handle cultural remains, how we review the rights of indigenous peoples, how we ended the activity of collection in general, and how we understand the changing roles and functions of natural history museums.

Dioramas are still important but perhaps not in the same way they were in the 1800s. They are still important in terms of species conservation, habitat protection and enhancing views of biological diversity among other important topics. They will continue to be places of imagination and wondering.

In this chapter I have argued that natural history museums can do a better job in separating out cultural remains from strictly natural history concerns. By examining various views of the intermixing of dinosaurs and indigenous peoples, we see how such indiscriminate mixing longer works. Worldviews have change drastically since the early days of natural history museums and most museums are working hard to catch up with those shifts. We have seen this reflected in the repurposing refurbishing and dismantling of dioramas. Such actions are necessary, but insufficient, to create the kind of changes we envision for the dioramas of the future, that is, any diorama containing so-called primitive' humans and their material artifacts. We know it is essential to have *representation* from the parties most closely involved. And, as we have seen from the various commentaries on even the National Museum

of the American Indian, in a book edited by Lonetree and Cobb (2008), even when such Native representation occurs, exhibit design is challenging. The Ziibiwing Center is one model for how things might be done differently.

The newer vision the Ziibiwing represents is not necessarily in the particular material artifacts represented, the difference instead, resides in the unique worldview and way of being Native Americans offer. When this unique worldview drives all decision-making, an entirely different experience is available to the viewer.

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Chapter 9
Intended and Realised Educational Messages of Dioramas – An International Comparison

Marianne Achiam and Martha Marandino

9.1 Introduction

A diorama is a diorama is a diorama. Or is it? It is easy to think that we 'know' dioramas, or in other words, that the phenomenon of the diorama is completely unambiguous across cultures. After all, dioramas share their origins in natural history museums in the early twentieth century, where they appeared in response to the new scientific notions of systems, ecology, and ecological communities (Marandino et al. 2015). In fact, the diorama exhibition genre was conceived as a specific means for exhibit designers to encode the ecological interactions and interdependence of plants, animals, and geo-climatic features of a given environment (Asma 2001; Fortin-Debart 2003) in a way that could be easily decoded by visitors. And as described in Chap. 6 of this book, the way we recognise and interpret dioramas at a basic level is indeed characteristic of the human perceptual apparatus across cultures. However, when we move beyond these basic *lexical* and *phrastic* levels of meaning making (cf. Achiam et al. 2014), the acts of encoding and subsequently decoding the diorama become increasingly contingent upon variables such as the individual experiences and preferences of the designers and visitors, the specific institutional conditions of the museum in question, and the broader societal and cultural context of the encounter (Marandino 2014).

In the following, we illustrate the multitude of conditions and constraints that influence the design and the subsequent interpretation of dioramas. Specifically, we compare two dioramas with respect to the processes by which they come into being,

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and the processes by which they are interpreted by visitors, across two contexts: The Zoology Museum of the University of São Paulo in Brazil, and the Zoology Museum of the University of Copenhagen in Denmark. We use a comparative approach because placing the conditions and constraints of two different cases in critical and dialectical relation to one another across cultures enables us to observe not only what these conditions and constraints are, but also, what they are not (Kreps 2006). Ultimately, we make the point that as museum practitioners and researchers, we must always question the constraints and conditions that surround the production of dioramas as well as their reception by museum visitors, to fully understand their educational role in contemporary natural history museums.

9.2 A Systematic Comparison

To ensure that our comparison of the two dioramas is carried out in a systematic and principled way, we employ the *hierarchy of levels of didactic co-determination* (Chevallard 2002; Artigue and Winsløw 2010). This framework was originally developed as a means to analyse the variety of phenomena that influence the design and outcomes of teaching-learning situations in schools, but has recently been adapted to museum contexts (cf. Achiam and Marandino 2014). Basically, this adaptation of the framework suggests that the multitude of conditions and constraints that affect (or *co-determine*) the design and educational outcomes of exhibits such as dioramas can be categorised according to their origin and manifestation in a hierarchy of levels. These levels range from the overarching societal and cultural contexts in which museums exist, down to the very basic levels of our interactions with our immediate surroundings (Fig. 9.1).

In the hierarchy of levels of didactic co-determination, the uppermost levels of *humanity*, *civilisation* and *society* refer to constraints and conditions to museum practice that originate or manifest themselves externally to the institution itself. Immediately subjacent to the external levels of the hierarchy, we find levels that refer to the upper organisational levels of the institution, i.e. *museum* and *pedagogy*. At the intermediate level of the hierarchy, we find *discipline*, which refers to the conditions and constraints to practices that come from the scientific discipline itself. Next, we find the levels of *exhibition*, *cluster*, *exhibit*, and *task*, which all refer to the conditions and constraints that are inherent in these museum-specific ways of organising content. Finally, we find the level *visitor knowledge*, because the entering knowledge of visitors (and exhibition designers' assumptions about this entering knowledge) is arguably the most fundamental co-determinant of the dissemination efforts of museums (cf. Achiam and Marandino 2014).

Fig. 9.1 The hierarchy of levels of didactic co-determination, adapted to the museum context. (After Achiam and Marandino 2014)

9.3 The Dioramas

The two dioramas we compare in the following are component parts of exhibitions at the Zoology Museum of the University of São Paulo (ZM-USP) and the Zoology Museum of the University of Copenhagen (ZM-UCPH), respectively. The diorama at ZM-USP is part of an exhibition entitled 'Research in Zoology: Biodiversity under the eyes of the zoologist', which offers visitors the opportunity to experience aspects of zoological research. The exhibition features a number of dioramas, each representing a distinct Brazilian ecosystem with its characteristic animal species. The spatial arrangement of the dioramas in the exhibition hall reflects the geographical distribution of the ecosystems in Brazil. The diorama selected for analysis here is part of a cluster of exhibits with the theme of 'Neotropical Fauna'; it represents the Amazon rainforest with a number of characteristic species: A jaguar (*Panthera onca*), a harpy eagle (*Harpia harpyja*) eating a macaque monkey (*Macaca sp.*), and an iguana (*Iguana iguana*) (Fig. 9.2).

The diorama at ZM-UCPH is part of an exhibition that shows the succession of ecological communities in Denmark. The exhibition is entitled 'Danish Fauna: From mammoth steppe to cultural steppe' and represents a journey through time, from 20.000 years ago when the glaciers of the latest ice age covered much of what was to become Denmark to the present-day cultural landscape. The exhibition features the remains of several extinct prehistoric animals, and a number of extant animals. A large number of the exhibits in the exhibition are dioramas, in which taxidermied animals are shown in their ecological and historical context. The

Fig. 9.2 The Amazon rainforest diorama from the Zoology Museum of the University of São Paulo (ZM-UCPH). (Photograph courtesy of Martha Marandino)

diorama selected for analysis here is part of a cluster of exhibits about contemporary Danish fauna, and represents a present-day beech forest (*Fagus sylvatica*) with some of its characteristic inhabitants: A roe deer (*Capreolus capreolus*) with two fawns, a chaffinch (*Fringilla coelebs*), and a slug (*Arion ater*) (Fig. 9.3).

9.4 Data Collection and Analysis

To determine how conditions and constraints influenced the development of the dioramas at the two museums, we collected a range of different types of data. We carried out semi-structured interviews with the two curators of each museum who were responsible for designing the dioramas. We collected all the available documentation of the dioramas, such as planning briefs, exhibition catalogues, and pamphlets. Finally, we photographed and documented the dioramas in detail.

To understand how visitors made sense of the two dioramas, we guided a number of adult visitors to the selected dioramas, and asked them to verbalise their thoughts. This procedure was carried out with five visitors at the Danish Museum of Zoology,

Fig. 9.3 The beech forest diorama from the Zoology Museum of the University of Copenhagen (ZM-UCPH). (Photograph courtesy of Jesús Piqueras)

and ten visitors at the Brazilian Museum of Zoology. After each of these 'think-aloud' sessions (cf. van Someren et al. 1994) we interviewed the visitors. All verbalisations were recorded on a digital recorder, transcribed, and translated to English.

The collected data were analysed using the *theoretical thematic analysis* procedure described by Braun and Clarke (2006). We used a 'top-down' approach, in which the eleven levels of didactic co-determination (Fig. 9.1) constituted our deductive framework. Briefly, this approach entailed our familiarising ourselves with the data, coding the data using the levels of co-determination as our focus, allocating the codes to themes, and reviewing the themes to ensure internal consistency.

In both the Brazilian and the Danish case, we found evidence of constraints and conditions at all eleven levels of didactic co-determination (for an overview, see Fig. 9.4). However, in the following we present the constraints and conditions that most prominently influenced the design and subsequent reception of the dioramas. We thus focus on the levels of civilisation, society, pedagogy, and discipline, and discuss how conditions and constraints that originate at these levels ultimately influence the two dioramas (at the level of exhibit).

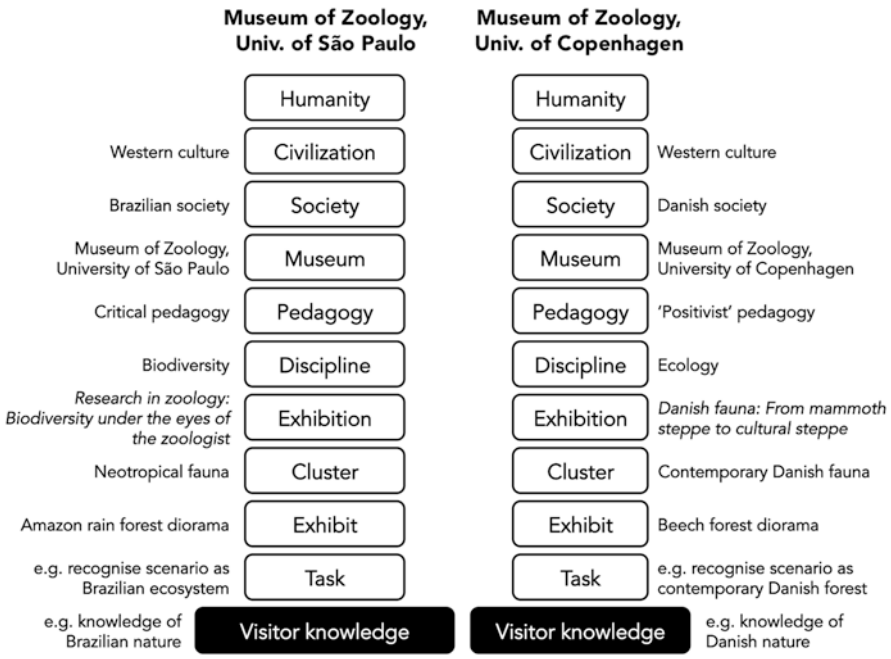

Fig. 9.4 The hierarchy of levels of didactic co-determination, with indications of the particular levels of organisation in each of the two cases: The Amazon rain forest diorama in ZM-USP (left) and the beech forest diorama in ZM-UCPH (right). (After Marandino and Achiam 2016)

9.5 Civilisation

Both Brazil and Denmark are representatives of Western Culture, meaning that they share a heritage of social norms, political systems, ethical values, etc. originating in Europe. This means that we can expect the Western model of the museum (cf. Hooper-Greenhill 1999) to condition the practices of exhibition designers and visitors in the two cases. Indeed, this influence is evident when one of the Brazilian exhibition designers describes their institution in the following way: 'the Zoology Museum is a museum… of natural history, it comes from this lineage' (Exhibition designer I, ZM-USP). In a similar way, one of the Danish exhibition designers discusses the design of the beech forest diorama at ZM-UCPH:

> In a little country like Denmark, we would be looking at greater museums like the natural history museum in London, the natural history museum in New York, the Smithsonian, and Paris, all that. And they would do it in such a way, so I think that's pretty much how to do it (Exhibition designer I, ZM-UCPH).

These statements seem to indicate that there is a 'correct way' to be a natural history museum, and that this 'correct way' is exemplified by certain influential natural history museums in the Western hemisphere. We can thus think of the practices of the archetypical Western Culture natural history museum as an ideal, a

constraint that *originates* at the level of civilisation. At what level does this constraint *manifest* itself?

In the example shown above, the Danish exhibition designer explicitly rationalises the design of the beech forest diorama in terms of this idealised practice: 'they would do it in such a way, so I think that's pretty much how to do it'. In this case, we can thus think of the diorama as a manifestation, at the level of exhibit, of the notion of an archetypical Western Culture museum (Fig. 9.5). However, not all visitors agree that a diorama is 'pretty much how to do it'. As she stands in front of the beech forest diorama, one visitor critiques the exhibit for not providing answers to her questions, and then continues to explain how she thinks a museum could go about answering the questions of visitors:

> I have a lot of questions that I don't get answered in this picture. […] I was at the American Museum of Natural History in New York, I think they did a very good exhibition about the dinosaurs, where they tried to show, okay, this is what we know; this is what could be; this is what we thought two years ago. I think that was a good way to tell, okay, what is science, and what do we exactly know and where are we guessing (Visitor I, ZM-UCPH).

It seems that this visitor agrees with the exhibition designer that there are archetypical natural history museums (i.e. the American Museum of Natural History). However, there is a tension between what the exhibition designer sees as the ideal practices of archetypical natural history museums, and what the visitor sees as the ideal practices of archetypical natural history museums. In stating that there are 'a lot of questions that [she doesn't] get answered' by the diorama, and referring

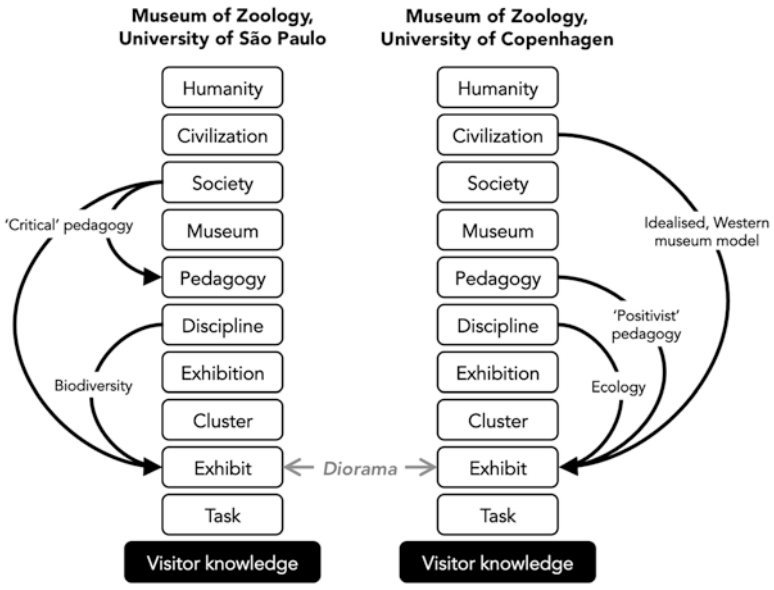

Fig. 9.5 Some of the origins and manifestations of conditions and constraints to the design and reception of dioramas at the Museums of Zoology of the University of São Paulo and the University of Copenhagen, respectively

instead to a dinosaur exhibition at the American Museum of Natural History as a good practice, the visitor seems to be critical of what could be called the 'positivist' pedagogy of the Museum of Zoology of UCPH; we will return to this point in the section on Pedagogy.

9.6 Society

An important condition for museum practice is the way the museum establishes its relationship with the society that surrounds it (McPherson 2006). In the present case, discussions about the two museums' expectations of their audiences, on one hand, and the interests and requirements of the visitors, on the other hand, revealed that the roles of the museums are linked in different ways to the social and cultural aspects of Brazilian and Danish society, respectively. One of the Brazilian exhibition designers explained:

> So, the museum has this goal, a more functionalist perspective, to give answers to these questions that are important to the people who live here. What are the situations that we have to fight in the agricultural, medical, and veterinary [areas]? (Exhibition designer II, ZM-USP)

This attention to providing answers to socio-scientific issues is not surprising in light of the debate about the role of museums in relation to society in Brazil in the last decades. The notion of critical pedagogy strongly influenced Brazilian society since the 1970s, especially with the work of Paulo Freire (1921–1997) who was a strong proponent of the idea that education should provide learners with the agency and consciousness to critique and address important social issues (Mendieta 2016). From the 1980s onwards, societal discussions about museums focused on whether they should be less collections-based and more education-based (Martins 2011). And, more recently, initiatives from Brazilian's Ministry of Science, Technology and Innovation indicated its preference to support educational museum activities that include minority groups of society (Falcão 2015).

These ideas remain influential in Brazilian educational practices today, including those of the Museum of Zoology of USP. We may think of these new perspectives as conditions that *originate* in Brazilian society and *manifest* themselves in the institutional pedagogy of ZM-USP (Fig. 9.5). As we shall see in the following sections, this 'critical' pedagogy also manifests itself at the level of exhibit.

We did not find explicit evidence of similar societal influences on the practices of the Danish Museum of Zoology. However, when queried about the exhibition 'Danish Fauna: From mammoth steppe to cultural steppe', one exhibition designer observed the following:

> You have an exhibition, you want to show a story about the natural history of Denmark through time, and this being a zoological museum, you want to show the animals (Exhibition designer I, ZM-UCPH).

This statement could be interpreted as a tacit reference to the museum's obligations as a nationally funded institution, as set out in the Danish Museum Act: 'The Danish natural history museums illustrate nature and its development, contemporary environment, and interplay with humans' (Ministry of Culture 2006). Irrespective of whether this is the case, the practices of the Danish Museum of Zoology certainly seem to be influenced to a lesser degree by conditions originating at the level of society than the practices of the Brazilian Museum of Zoology.

9.7 Pedagogy

In the hierarchy of levels of didactic co-determination, pedagogy may be thought of as the overarching institutional principles for teaching that transcend particular subjects. This pedagogy may be explicit in a museum's mission statement or more implicit, e.g. as a customary way of doing things. We have already discussed how the political, social, and educational movements in Brazilian society have become embedded in many of its educational institutions, including the Museum of Zoology of USP. The Museum of Zoology of UCPH, on the other hand, does not have an explicitly stated institutional pedagogy. However, the remark made by the exhibition designer in the preceding ('you want to *show* a story about the natural history of Denmark […], you want to *show* the animals'), seems to be based on what could be called a 'positivist' pedagogy. By this we mean an institutional approach to education, which assumes that if the museum displays specimens, objects, and environments for visitors to observe, then visitors can and will infer knowledge about the real world by observing those displays (cf. Hooper-Greenhill 1999). We shall see further evidence of this 'positivist' pedagogy in the section Exhibit.

In the interviews with exhibition designers from both museums, then, we found evidence of institutional pedagogies. How did these pedagogies *manifest* themselves? In the case of the Brazilian Museum of Zoology, we observe one visitor use the Amazon rainforest diorama to raise the topic of the degradation of animal habitats:

> Well, the jaguar is a beautiful animal, so I think it already draws attention for that reason. It is an endangered animal, so it has a certain appeal, and being endangered, we begin to think about the degradation of the environment (Visitor II, ZM-USP).

Another visitor takes a similar, critical stance towards the impact of humans on the environment with a point of departure in the diorama:

> It attempts to present the way, I think, the animals live in the environment, right? A nice forest, looking at what is the Amazon rainforest. […] And it's the original environment, right, because humans are not present (Visitor I, ZM-USP).

In the case of the Danish Museum of Zoology, a number of visitors take the diorama at face value, which seems to indicate that they go along with its positivist premise. For example, one visitor interprets the diorama in the following way: 'If I

was lucky, I could see the animals in this forest here in Denmark (Visitor II, ZM-UCPH). Other visitors are more critical of the 'positivist' pedagogical approach, e.g.:

> I get a lot of questions or stories that could have been told, but aren't part of the picture, I mean how old do they get, what do they eat, who will eat them, eh… bla bla bla. Eh, there are a lot of stories, but untold (Visitor I, ZM-UCPH).

In summary, it seems the institutional pedagogies of the two museums manifest themselves in the dioramas in different ways, leading to differences in the ways the dioramas are interpreted in the two cases. In the following sections, we present further evidence to support this claim.

9.8 Discipline

The term 'discipline' describes a branch of knowledge unified by a common epistemology and ontology, e.g. biology or physics. The level of discipline in the hierarchy of levels of didactic co-determination thus refers to the conditions and constraints to museum practice that pertain to the nature of the particular branch or branches of science (Achiam and Marandino 2014). In the Brazilian Museum of Zoology, the diorama is part of an exhibition called 'Research in Zoology: Biodiversity under the eyes of the zoologist'. One of the exhibition designers discusses this:

> The name of this exhibition on display now is 'Research in Zoology: Biodiversity under the eyes of the zoologist'. What is the idea behind that? The focus is no longer, no longer on the animal; it is on the *research* on the animal, and the perspective of the zoologist on biodiversity (Exhibition designer II, ZM-USP).

Biodiversity can be understood as a measure of the variety of living organisms present in a given ecosystem (Lawrence 1989). Accordingly, when the exhibition designer explains how they 'increased the number of animals that were in the diorama, to represent the Amazon', and further, that they:

> …tried to find ways to also include invertebrates, which were not in the dioramas, that we have in the Amazon. […] You have some glass cases that display these insects [including] some other invertebrate groups because they are also representatives of the ecosystem (Exhibition designer II, ZM-USP).

…we can interpret this to mean that the subject of biodiversity is a constraint, *originating* at the level of discipline and *manifesting* itself at the level of the exhibit (Fig. 10.5). We see further evidence of this manifestation among visitors to the diorama. One visitor states:

> Here I missed seeing, for example, that… here it seems that there are only vertebrates. They missed having some invertebrates as well. It would be interesting perhaps, [to see] a butterfly or another animal that is part of the environment, of this ecosystem (Visitor I, ZM-USP).

Another visitor observes the diorama, saying:

> Well, in this environment I see the forest, [and] many plant and animal species. […] In short, the scenario gives me the idea of a very biodiverse [*sic*] environment, as I said, with many plant and animal species interacting, I think that's it, that's the idea of it (Visitor II, ZM-USP).

In the Danish Museum of Zoology, the diorama is part of an exhibition called 'Danish Fauna: From mammoth steppe to cultural steppe'. The exhibition's sequential progression through 20.000 years is illustrated mainly through dioramas, thus representing the ecological succession of Denmark through a series of 'snapshots' of ecosystems. One of the exhibition designers discusses the exhibition:

> Well, that is a very scientifically based exhibition. In the case of the deciduous forest, it's a picture of a time that is no more, and animals that are no more in Denmark. […] The Department of quaternary zoology – quaternary, it's a period from the last ice age –of course had all the data and all the research and so they were the ones making the stories and selecting the animals. From the bones, saying: 'Okay, we have in fact a few lynx bones; that means that once upon a time, there was lynx in Denmark, and we want to show the bones, and then we can show what it looks like. So there's a lot of research and a lot of specimens from the collection in that exhibition. That has taken a lot of research (Exhibition designer II, ZM-UCPH).

Similar to what we saw in the case of the Brazilian exhibition, disciplinary content was a constraint for the development of the Danish exhibition 'Danish Fauna: From mammoth steppe to cultural steppe'. The exhibition permits visitors to experience how the Danish fauna has changed since the last Ice Age (Natural History Museum of Denmark n.d.) and in the specific case of the beech forest diorama, the exhibition designer explains:

> If you want to show nature, you have to copy it. The intention is to make as exact a copy of nature as possible. So you would have every little detail. […] Let me take the beech diorama. You just have to go out and say – 'oh, it looks like that' and you just do it like that. That's just copy-paste (Exhibition designer II, ZM-UCPH).

As we discussed in the preceding section on Pedagogy, the 'positivist' institutional pedagogy of the Danish Museum of Zoology seems evident in the beech forest diorama, and there is seems to be further evidence of this approach in the exhibition designer's tacit assumption that 'showing what it looks like' and 'mak[ing] as exact copy of nature as possible' will provide visitors with observable and verifiable facts about ecology. In fact, the designers emphasise how an accurate copy of nature should avoid the mistake of including too many animals in one place:

> We don't want to put very many animals together; it's not normal, it's not natural. There's a quite different way to make dioramas, and that is to show everything that could be here. But we don't like that model (Exhibition designer I, ZM-UCPH).

We may thus think of ecology as a constraint for the design of the beech forest diorama that *originates* at the level of discipline and *manifests* itself at the level of exhibit. Some visitors take the ecological messages of the diorama at face value, e.g.

> This is a forest landscape, and there is a deer, with two young. I don't really see many other animals here, but there're quite a few beech trees. It's all beech forest, actually (Visitor III, ZM-UCPH).

> Yeah, I think it's sweet, that the baby deer… it's fine that they are all looking at you, and it's a good effect with the forest (Visitor IV, ZM-UCPH).

Others remain more critical of the diorama's intended ecological message. In the following, the visitor seems to understand the meaning she is intended to make from her interaction with the exhibit, but seems to yearn for more from the museum:

> Eh, for me it's like a painting; it's very idyllic, with green forest and… yeah, it's nearly like a painting. So, the deer with its small child [*sic*], and so on. So it gives me a romantic impression of life here; there are no dangerous things in it. And I like the background because it… it's natural. But then again, it's… what it gives to me is that it… OK, I find the animals and that's that (Visitor I, ZM-UCPH).

In summary, we find that disciplinary content related to biodiversity and ecology, respectively, influences the way the dioramas are perceived by visitors. Even though the two dioramas have similar educational mechanisms (cf. Chap. 6), the visitors to the Brazilian Museum of Zoology interpret the Amazon rainforest diorama from a biodiversity perspective (appreciating the variety of species; lamenting the absence of invertebrates) while the visitors to the Danish Museum of Zoology interpret the beech forest diorama from a naturalistic, ecological perspective (enjoying the 'forest' and the presence of the deer). In the final section, we draw together our findings, and discuss what we see as their most important implications.

9.9 Discussion

Taken together, our findings show evidence that although dioramas may seem unambiguous across cultures, the encoding of dioramas by designers and the decoding of dioramas by visitors is contingent upon a number of cultural, social, institutional, disciplinary, and individual variables. A diorama is not simply a diorama. This means that if we are attempting to understand how educational themes are represented and disseminated by dioramas, we must question the constraints and conditions that co-determine that encoding and decoding. Here, we suggest that the hierarchy of levels of didactic co-determination provides a suitable framework for such inquiry.

Although the scope of the present text did not allow for an exhaustive analysis of our data, we gave examples of conditions and constraints originating both externally and internally to the museums. We shall discuss these in turn. First, it is not surprising that conditions and constraints originating outside the museum can influence museum practices (cf. Marandino 2014); indeed, as pointed out by Kreps (2006, p. 312):

> Museums and museological work do not exist in a vacuum, but are part of larger sociocultural systems that influence how and why curatorial work is carried out. Because curating cannot be divorced from these contexts, it seems appropriate that scholars and museum practitioners are redefining curating in terms that acknowledge the social and cultural dimensions both of objects and of curatorial work.

In other words, despite the fact that Brazil and Denmark both represent Western Culture, and despite how the interviewed exhibition designers recognised their respective institutions as belonging to the same genealogy of Western Culture natural history museums, this 'membership' did not make the respective museums immune to the effects of their surrounding culture and society. That is, even though the institution of a natural history museum in itself is Eurocentric (cf. Kreps 2006), the national and institutional idiosyncrasies detected in this study may be evidence of a partial 'liberation' of the natural history museum from the constraints of its origins, and its increasing degree of adaptation to more local conditions.

A more practical point to make in this connection is that conditions and constraints that originate externally to the museum are typically beyond the immediate control of museum staff members as well as researchers. In the present text, we gave examples of societal conditions and constraints of a more ideological nature, but it is easy to envision other types of external constraints to museum practice, e.g. political (McPherson 2006), financial (Lindqvist 2012), or even religious (e.g. the Creation Museum in Kentucky, US) constraints. In these cases, it is important to *acknowledge* that these conditions exist, even though the staff member or researcher in question may be powerless to change them.

In addition to the external conditions and constraints, the present study also demonstrated how a number of constraints and conditions originated internally, within the walls of each museum. This is not surprising either; however, in the comparison between the two museums, these differences suggest that there is a substantial idiosyncrasy at work in the internal mechanisms of museums. Specifically, our results seem to point out that the practices of the Museum of Zoology of the University of São Paulo are conditioned by a desire to directly address the local audience and provide them with the tools to critically engage with the methods of science (in this case, biodiversity), while the practices of the Museum of Zoology of the University of Copenhagen seem conditioned by an obligation to more uncritically 'show' the products of science (in this case, ecology). In both cases, these intentions were perceived by the museum visitors, even though the studied dioramas themselves seemed to be based on quite similar ideas.

In an extension of this discussion, it is interesting to note that the Museum of Zoology of the University of Copenhagen has changed its pedagogical practice since the exhibition 'Danish Fauna: From mammoth steppe to cultural steppe' was inaugurated in the 2000s. One of the exhibition designers describes the new approach in the following way:

> It would probably be more, like, not being afraid to say 'this, in fact, we do not know the exact facts about. We don't know, but it could be that…'. Take, for instance a whale, 'we don't know how it uses its echo localisation'. […] So there would be more, not explaining, but more making people curious, saying 'wow, that's interesting' (Exhibition designer II, ZM-UCPH)

It thus seems that the Danish Museum of Zoology is moving away from the 'positivist' pedagogy observed in the present study, and embracing the uncertainties of doing science, thereby aligning itself better with recommendations in the museum research literature (Arnold 1996; Shapin 1992).

We conclude our discussion by pointing out that far from being unambiguous, dioramas may be thought of as *homologous* phenomena. That is, dioramas have a common origin, but not necessarily the same function across cultures, because individual societies, communities, and institutions have patterned ways of seeing, valuing, ascribing meaning to and treating scientific objects and practices (cf. Kreps 2003). This means that without due consideration of the conditions and constraints that co-determine those functions in each context, studies of dioramas (and, indeed, of any museum practice) run the risk of drawing simplistic conclusions.

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Part III
Connecting People with the Natural World Through Dioramas

Chapter 10
Promoting People's Connection with Nature Through Natural History Displays

Henry A. McGhie

10.1 Introduction

This chapter explores the proposition that natural history museums can play an important role in connecting people and nature, by supporting them to develop their own understanding of nature, to appreciate its value, and to have a positive attitude to their surroundings. The proposition is explored in regard to dioramas and diorama-making. It is based on the belief that museums can be far more than some kind of 'dead zoo' or cabinet of curiosities (whether as freak show or dilettante spectacle), but can be a powerful medium for promoting critical thinking and reflexivity, can encourage people's self-knowledge of the world and their place in it, and can promote people's connection with nature. The chapter is themed around the benefits to be gained by people engaging with nature for both 'parties', and how museums can effectively support this interaction.

For the purposes of this chapter, 'nature' is taken in a broad sense to include animals, plants and wild places (however defined), natural resources, people's day-to-day surroundings and the ways they are experienced. People and nature are not regarded as distinct entities, and indeed the interaction and distinction between people and nature is a key consideration throughout this chapter. 'Dioramas' are taken in the broadest sense, to include displays that incorporate animals with some kind of pretension of habitat (see Kamcke and Hutterer 2015). They are cultural constructs insofar as their creation, acquisition and preservation of specimens, production, presentation and use in museums are culturally determined activities (*contra* Tunnicliffe and Scheersoi 2015: 2–4).

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10.2 The State of Museums and Dioramas

The history of dioramas and diorama-making is well-known through the work of Wonders (e.g. 1993a, b), Rader and Cain (2014), Tunnicliffe, Scheersoi and others (2015). As a précis, nineteenth century natural history museums were, arguably, largely concerned with presenting evolution, or at least evolutionary relationships (e.g. Yanni 2000, Bennett 2004). Mounted specimens were exhibited in staid displays, with closely related (evolutionarily and taxonomically) species grouped together, usually devoid of any attempt at habitat and often devoid of interpretation. These so-called evolutionary galleries were often anything but: evolutionary relationships were used as a silent organizing principle without mentioning evolution or natural selection (see Bennett 2004). This approach continued to dominate many UK and US museums until the latter part of the twentieth century, with examples including the natural history galleries of Manchester Museum, World Museum Liverpool (until they were destroyed by bombing during the Second World War), the Natural History Museum (formerly the British Museum (Natural History) and many more.

The late nineteenth and early twentieth centuries saw the rise of the great dioramas so distinctive of many US museums. Their development coincided with the rise of the conservation and National Park movements, and a time of concern for the preservation of a rapidly vanishing world. The same key actors and commentators were sometimes involved in the diorama-making and conservation movements (e.g. William Hornaday), producing extraordinary visual documents that combined wonder with loss to present the victims of progress. The situation was different in Britain where diorama-making was never so tied with ideas of wilderness preservation. The growth of museums in the nineteenth century came after the British fauna had been largely tamed as a result of habitat change, over-hunting and deliberate persecution. Brown Bears, Wolves, Wild Boar (Pig), Cranes and Bustards had all been extinguished, while birds of prey and most other large bird species had been greatly reduced in numbers. The largest land Carnivores—Foxes and Badgers—were no larger than a small dog, while the largest land mammal, the Red Deer, was the size of a small pony. The British fauna was thus more easily 'domesticated' than that of the US or most European countries, as most British species could be accommodated as decorations within the average home.

By the time diorama-making was reaching its zenith in American museums in the early decades of the twentieth century, natural history collecting had fallen into decline in the UK and collecting was in conflict with the growing nature conservation movement. Consequently, British museums never contained dioramas on a par with the great displays of the AMNH, Field or other large US or Scandinavian museums. It is worth noting that the two people who embraced dioramas most wholeheartedly in nineteenth-century Britain were (wealthy) private individuals. Edward Booth (1840–1890) was an early proponent of 'habitat groups', which documented his self-set goal of attempting to shoot every species of British bird in its breeding grounds; these can still be seen at the Booth Museum in Brighton. Major

Percy Horace Gordon Powell-Cotton (1866–1940) founded the Powell-Cotton Museum adjacent to his home at Quex Park, Birchington-on-Sea, Kent. Specimens shot by Powell-Cotton were presented in stupendous dioramas by the famous firm of Rowland Ward. Nevertheless, many UK museums included displays of British birds and mammals 'at home' in 'habitat groups' from the late nineteenth century onwards. Excellent dioramas existed in large numbers, but on a smaller scale, in private homes; many of these passed to museums as their owners passed on, downsized, or as their owners' descendants lost interest in their private collections.

Dioramas became increasingly common towards the end of the twentieth century and can still be seen in e.g. World Museum Liverpool, Kendal Teaching Museum, Bristol Museum, Tullie House (Carlisle) and Inverness Museum and Art Gallery, to name but a few.

The uses and interpretation of dioramas has reflected, or tried to accommodate, shifts in attitudes to nature, and in museum education methods. These shifts have not always run smoothly, as differing schools of thought developed in terms of what constituted 'science' and 'science education' and what its role should be (see especially Radar and Cain 2014).

In summary, dioramas have arisen from different sentiments and, especially outside of the US and Scandinavia, have lacked a clear purpose or rationale. A number of natural history galleries have been redisplayed within the last few decades, both in the UK, US and elsewhere, sometimes replacing dioramas with alternative exhibition techniques, or creating dioramas in new forms.

10.3 The State of Nature

While museums have undergone internal transformations the condition of nature, and our understanding of this, has been similarly transformed. By the end of the twentieth century, it was widely appreciated that humans were having unprecedented effects on the environment, including the loss of high-level ozone in the 1980s, the biodiversity crisis (notably from the 1980s), global warming and climate change, to give some pre-eminent examples. To give one example, the Convention on Biological Diversity (1993) is an international agreement to which the UK is a signatory, established to halt ongoing losses of biodiversity. This is supported by the Strategic Plan for Biodiversity (2011–2020), with the vision that 'by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.' The Plan has five main goals and twenty targets, the Aichi Targets, to monitor progress towards 2020. The latest progress report showed that none of the targets are currently on course to be met and the situation has actually worsened since 2011 in terms of habitat degradation and fragmentation, nutrient pollution, status of coral reefs, rare species getting even rarer, and effects on poor communities (Secretariat of the Convention on Biological Diversity 2014a: 18–22, 2014b). The European

Commission's mid-term (2015) assessment of progress towards the European Union's Biodiversity Strategy to 2020 found that of eight targets to protect and enhance biodiversity, only one was on track and no progress had been made with three of the targets.

The 'Living Planet' report (2014) assessed there to be half as many individual birds, mammals, reptiles, amphibians and fish as there were 40 years ago. In Europe, 23% of species are currently threatened with extinction. The same situation pertains to the UK, where the 'State of Nature' report (Burns et al. 2013) found that nearly two thirds of animal and plant species are rarer than they were 40 years ago. The UK has lost around 44 million breeding birds since the 1960s, and 72% of UK butterfly species declined between 2001 and 2011.

In short, nature conservation is not making enough progress to halt biodiversity losses. Increasingly, nature conservation strategies include the importance of engaging people with biodiversity and nature, as a positive, connected relationship with nature is linked to pro-environmental attitudes and associated behaviours (Mayer and Frantz 2004; Nisbet et al. 2011; Davis et al. 2011). At an international level, the Paris Agreement (United Nations 2015a) and the UN's 17 Sustainable Development Goals (United Nations 2015b), to transform our world by 2030, acknowledge the key role that civic engagement will play a key role in the transition towards a more sustainable future (Table 10.1). In the UK, wildlife conservation charities have redirected their attentions beyond protecting pockets of land and habitats, and are aiming to connect with people's values to begin to address structural problems concerning contemporary society and its relationships with (and impacts upon) the environment (e.g. Blackmore et al. 2013a, b).

10.4 The Need to Connect People and Nature

A substantial body of evidence has grown to demonstrate the benefits of contact with nature for people's health and wellbeing (e.g. Natural England 2012; Capaldi et al. 2014; Bragg and Atkins 2016). Contact with nature has been shown to reduce recovery time from illness, promote physical fitness, help reduce people's blood pressure, help people cope with stress and maintain or regain concentration; contact with nature helps people's general outlook and satisfaction with life (Natural England 2012). In the UK these health and wellbeing benefits are acknowledged in various government policies (e.g. HM Government 2010, 2011). The wider benefits of contact with nature, incorporating people's shared and collective values, is recognized within the National Ecosystem Assessment, an important framework that directs Government environmental policy in the UK (UK National Ecosystem Assessment 2014: 54–57). Engagement with the natural environment is measured and reported as an official statistic through the Monitor of Engagement with the Natural Environment (MENE).

The Department for Communities and Local Government (2015) measures social deprivation in England through a combination of scores for the seven domains

Table 10.1 Calls for greater public/civic engagement with biodiversity and the environment from key strategy documents

Paris Climate Agreement (United Nations 2015a)	Article 12: Parties shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement.
Sustainable Development Goals (United Nations 2015b)	12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.
	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
Global Biodiversity Outlook 4 (Secretariat of the Convention on Biological Diversity 2014, b)	By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.
Biodiversity 2020 (DEFRA 2011)	It is crucial to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help. Civil society organisations play a front line role, directly engaging and enthusing the public about biodiversity. We will work with them to engage more people and empower them to make a difference…
	By 2020, significantly more people will be engaged in biodiversity issues, aware of its value and taking positive action.
	Rationale: Public understanding and opinion on the value of biodiversity has strong implications for the acceptance and adoption of conservation measures.
UK National Ecosystem Assessment (2011)	A move to sustainable development will require an appropriate mixture of regulations, technology, financial investment and education, as well as changes in individual and societal behavior and adoption of a more integrated, rather than conventional sectoral, approach to ecosystem management. This will need the involvement of a range of different actors—government, the private sector, voluntary organisations and civil society at large…
Natural Choice White Paper (UK Government 2011)	We want more people to enjoy the benefits of nature by giving them freedom to connect with it. Everyone should have fair access to a good-quality natural environment. We want to see every child in England given the opportunity to experience and learn about the natural environment. We want to help people take more responsibility for their environment…

of income, employment, education, health, crime, barriers to housing and services, and the living environment, both indoor and outdoor. The most deprived areas are mainly inner cities and former industrial areas in the north of England; the same situation applies to Scotland and Wales, where the data collection occurs by order of the respective governments, although social deprivation is measured in slightly different ways. Availability of nature mirrors social deprivation, which means that

the majority of people who could benefit most from access to nature, i.e. those living in inner cities in deprived areas, generally have least access to it. The MENE survey found that people less likely to visit the outdoors include the BME population, people from lower-income socio-economic groups, people aged over 65 and people with a long-term illness or disability (Natural England 2015).

There are great contrasts in both social deprivation and availability of high-quality nature across relatively short distances. This situation can be seen easily in the North West of England, which combines outstanding wild spaces in the Lake District, Pennines and along the coast within a relatively short distance of the urban areas of Manchester, Liverpool and Knowsley, which are among the most deprived in Britain. This situation means that high quality nature, while not immediately available to those in deprived areas, may not be far away.

At the same time as the evidence base has grown to show the value of contact with nature for people's health and wellbeing, evidence has also grown that people spend less time in nature. For example, the proportion of children in England who play in nature has declined by over 75% in the last 30–40 years (Natural England 2009: 5, 7). In the US, 96% of adults reported the outdoors as their most important environment during childhood, while 46% of children acknowledged the same importance; a child spends less than 40 min a week outdoors compared with more than 4 h 20 years ago (Kellert 2012). This is not to say that people are not concerned about the environment, and there is abundant evidence that most people care about nature in some way. The MENE for 2013–2014 found that 85% of people were concerned about damage to the natural environment and 95% of people were glad that natural places existed, even if they may never visit them (Natural England 2015). However, people may not know how to contribute positively towards a better natural environment.

10.5 Bridging the Gap

Given the foregoing, there is widespread acknowledgment of the need to find ways to connect people with nature. The late Stephen Kellert, formerly of Yale University, undertook extensive surveys in the early 1970s to establish a typology of attitudes to nature in order to categorise, compare and analyse attitudes to nature in groups of people. This work demonstrated differences in attitudes to nature based on people's age, gender, cultural groups and occupation. This work has been extremely influential in a range of fields, but has scarcely been embraced by museums or museum education in spite of its clear relevance. Kellert and Edward Wilson extended the work as a framework in support of the Biophilia Hypothesis, which posits that people have an innate affiliation with nature made up of an array of values and qualities (Kellert and Wilson 2012; Kellert 2012).

The Biophilia Hypothesis has helped influence the development of a number of measures of nature connectedness (see Lumber et al. 2017). Nature connectedness describes an individual's relationship with nature, based on the extent to which their

conception of self includes nature (Tam 2013, Capaldi et al. 2014). Nature connectedness offers a way to identify and evaluate pathways and interventions that promote a connection with nature. For example, Richardson et al. (2015) identified aspects of nature that were identified as positive by respondents with particular reference to 'mundane nature' in urban settings. Positive aspects identified by respondents included [multisensory] sensations of nature, growth and temporal changes, wildlife activity, specific animals and plants, beauty or wonder of nature, effect of weather and specific weather events, colours of nature, animals interacting, and good feelings from nature. Building on this work, Lumber et al. (2017) identified contact, emotion, compassion, meaning and beauty as pathways that promoted connectedness with nature. Knowledge of this kind provides a possible means for museums to use their collections and exhibitions to connect people and nature, both nearby and more distantly, although some themes would be easier to work with in museum settings than others.

10.6 A New Purpose for Natural History Museums

In an increasingly urbanized world, museums and other 'mediated nature' experiences will become increasingly important as potential sites for environmental education and influencing nature connectedness. As Miller et al. (2004) note: "*zoos, aquariums, museums, and botanical gardens… present an exceptional opportunity for many urban residents to see the wonders of life, and they can contribute to education and habitat preservation.*" Conservationists have called upon zoos to redirect their missions to address conservation and environmental education explicitly, with some success, giving them a role in keeping with contemporary concerns of wildlife conservation (see references in Miller et al. 2004). The museum sector has been slower to accept this mantle, although environmental education and related activities feature in the exhibitions and programmes of many museums, especially those with natural history collections. Such a purpose can be extrapolated from expectations within museum sector policies and strategies that museums should contribute positively to society, which can provide these museums with a rationale based around enabling the achievement of aims around civic engagement with environmental issues, in the broad sense, in order to realize environmental sustainability. This is the much needed "integrated, rather than conventional sectoral, approach to ecosystem management" incorporated in the National Ecosystem Assessment (see above). This socially engaged purpose for museums of natural history transforms their role from being about preserving things from the past—a role which is perfectly suited for dealing with the preservation of archaeological artefacts and natural history specimens as an archive of nature—into one that also embraces the exploration of the present and indeed the future as key concerns, for the benefit of both people and communities, and nature, and replacing a value-laden 'natural history' with an exploration of 'natural heritage'. While this may seem obvious, it remains that, for many people, museums are identified with preserving the past in perpetuity.

This is not the way that things need to be, as Harrison (2013) writes: 'heritage is not a passive process of simply preserving things from the past that we choose to hold up as a mirror to the present, associated with a particular set of values that we wish to take with us into the future. Thinking of heritage as a creative engagement with the past in the present focuses our attention on our ability to take an active and informed role in the production of our own 'tomorrow'' (Harrison 2013: 4).

10.7 Making It Happen

Based on an acceptance of the premises above, it only remains to explore how museums might effectively promote people's connections with nature. Museums typically focus on providing factual information on the specimens on display—what they are, their scientific names, where they (often their species) are found, what kinds of habitat they are found in—that are usually displayed behind glass in display cases, an exhibition method that has dominated museums since the nineteenth century. Advances in environmental communications and messaging have a great deal to teach museums, who—together with other 'mediated nature experiences'—will need to synthesize knowledge from diverse disciplines if they are serious about connecting people and nature. Those who have staged dioramas in museums have often focused on the scientific information to be gained from them, while it may be that the viewing public is more concerned with other types of knowledge or relationships with nature. Notably, evidence from leading environmental communications agencies and applied social sciences advises that messages based on threat and loss are likely to demotivate rather than motivate, yet these are among the most commonly found messages in museums and many television programmes about nature (Futerra 2010; Blackmore et al. 2013a, b). Similarly, Swaisgood and Sheppard (2010) made a plea to conservation biologists to ensure that they present a message that incorporates some element of hope, and the same plea should be directed towards those developing exhibitions and programmes about nature in museums.

Museums of natural history were established as part of the scientific revolution and, for the most part, reflected an anthropocentric (contra biocentric or ecocentric) view of nature, where humans were separate from, or placed above, the rest of nature; this view is held to be partly responsible for the disconnection between people and nature (Thomas 1983; Merchant 2006; Kellert 2012). Museums have used well-established techniques to the extent that the museum provides a frame—a short-hand method of meaning-making—that can be explored and subverted in different ways to disrupt visitors' perceptions of museums, their displays, and viewers' own relationships with nature.

Historic museums are often constrained in their ability to alter their galleries and display cases as these are subject to various kinds of preservation orders. Far from being a hindrance, this can be used to a museum's advantage to subvert the modernist origins of its galleries. At Manchester Museum, the Living Worlds gallery (2011)

has 'authentic' Victorian display cases dating back to 1888 that are themed by a combination of environmental topics and attitudes to nature adapted from Kellert's work to reflect contemporary concerns (McGhie 2012). Gone are the 'Odd-toed ungulates', 'Pinnipeds', 'Marsupials and Monotremes' of the previous (1980s) gallery, replaced by neon-lit cases entitled 'Life', 'Humans', 'Domination', 'Symbols', 'Variety of life' and 'Connect', among others. Dioramas incorporate elements of the traditional diorama to explore contemporary themes: a Mouflon (wild sheep) wears a blue woolly jumper in a 'diorama' with furniture and a backdrop representing a domestic interior to explore the theme of natural resources in our lives (Fig. 10.1). In another showcase, animals 'escape' from the British countryside, the rainforest and the Arctic to exemplify a theme of interconnectedness by breaking out of the 'usual' museum frame of dealing with animals habitat by habitat. Both of the aforementioned examples adopt traditional diorama-making methods in using trompe-l'oeil to give illusions of depth and perspective. Another diorama incorporates a taxidermied Crane with a piece of rubble from the Hiroshima atomic blast in an 'environment' of paper origami cranes to tell a story of the benefits of nature for people's health and wellbeing (Fig. 10.2).

Museums that are not so constrained by historic environments have made different use of techniques to present nature and people's place in it. The recently refurbished Kenneth E. Behring Hall of Mammals at the Smithsonian National Museum of Natural History in Washington DC includes stupendous displays of

Fig. 10.1 Living Worlds, Manchester Museum, University of Manchester. Note the Mouflon (wild sheep) in the woolly jumper in a modern 'diorama' featuring the interior of a domestic flat. (© Ant Clausen)

Fig. 10.2 Peace Display, Manchester Museum, University of Manchester. A mounted Crane and piece of rubble from the Hiroshima atomic bombing are surrounded by origami cranes that escape from the display case. (© Ant Clausen)

large mammals in imaginative diorama-like settings. An expansive display of an American forest during the fall makes bold use of colour and plays with the ever-present glass front to displays by fixing wind-blown leaves to the 'invisible' surface, giving them a new function in display. Animals shown behind large glass screens, as opposed to fully enclosed cases—provide an uplifting sense of space and freedom. Unexpected, dramatic large animals out of cases add further drama: a Leopard rests on a branch with its antelope prey above an entrance, in a pose familiar from wildlife documentaries. Projections on large sheets of fabric provide further drama and an impressionistic representation of the colours and textures of habitats, and are combined with sound for added drama. At the Svalbard Museum in Longyearbjen (Spitzbergen), taxidermied animals roam on open display while visitors are confined to a slightly raised wooden walkway (Fig. 10.3). Natural materials (pebbles) on the floors of display cases soften hard lines, while unapologetically modern materials help visitors to focus on animals and imagined lines (representing animals' burrows, for example). Flying skeins of Barnacle Geese consist of one or two taxidermied specimens, with the remainder of the skein being made up of neutrally coloured models, drawing the eye as when viewing living birds in flight.

Fig. 10.3 Modern 'diorama', Svalbard Museum. Note the conscious use of natural and man-made materials. (© Katya Eklund, Svalbard Museum)

10.8 Conclusion

Through this chapter I have attempted to show that a pressing need to engage more people with nature has been identified as key to promoting greater environmental sustainability, and that a clear need has been identified to 'do things differently'. Similarly, people's need for nature as part of their health, wellbeing and general fulfillment has been identified. Museums provide unrivalled opportunities to help large numbers of people establish or deepen their connection with nature. Through effective and sensitive engagement and interpretation, museums could help catalyze mutually beneficial relationships and connections between people and nature. Such a programme of activity should be seen as central to the programming activities of museums that seek to educate and inspire people about the natural world. In order to achieve this, museums should critique their own practices and communications around the environment and nature, to ensure that the messages they use contribute positively towards nature connectedness and support visitors to take positive actions they wish to take.

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Chapter 11
Receiving the Message – Environmental Education at Dioramas

Annette Scheersoi and Lara Weiser

11.1 Introduction

Environmental education (EE) is of increasing importance. It encompasses different dimensions of affect, knowledge, skills and behaviour (McBride et al. 2013). The contribution of biology educators is to provide a scientific perspective that goes beyond presenting factual information. It is not to teach the 'right answers' but to equip citizens to take part in debates focussing on environmental issues (Slingsby and Barker 2003). To address the values and attitudes in developing an environmentally conscious behaviour, it has been suggested that the key entry point for environmental education is via the affective domain (Iozzi 1989), and Littledyke (2008) argues that the cognitive and affective domains need to be explicitly integrated in a science education that includes environmental education. Storksdieck (2006, p.16) specifies some basic structural problems that formal environmental education seems to suffer from: (I) EE is marginalized in the school curriculum, (II) discipline-based instruction does not fit the interdisciplinary nature of most environmental problems, (III) schools fail to inspire students (in contrast to mass marketing), (IV) the mass media influence students, leaving them confused, (V) schools lack the media means to connect students emotionally with abstract global issues and (VI) schools rarely provide opportunities to practice pro-environmental behaviour. Storksdieck argues that out-of-school environments can enhance formal environmental education by being both complementary of and supplementary to schools. Many zoological gardens have indeed an emphasis on different aspects of environmental education, especially on conservation of the living world, including endangered species. However, this educational task is often difficult for visitors because they have a limited knowledge of the complex field of conservation biology. Therefore,

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educators need to introduce them step by step to these issues, to overcome their knowledge and understanding deficit and probably also their interest deficit (Tunnicliffe and Scheersoi 2009; cf. Fig. 11.1, "conservation pyramid" representing a model for the progression of knowledge and understanding of concepts in biodiversity and conservation biology; as this model was derived from investigating spontaneous conversations it might be as well considered as a hierarchy of the degree of interest as discussed by Dove and Byrne (2014)).

11.2 Hypothesis and Research Question

We suggest that museums which contain natural history dioramas could also contribute to environmental education and might be even superior to other out-of-school learning environments in regard to certain key aspects: Interrelationships between animals, animals' needs and habitats can only be presented partially with living animals, in zoos or when observed in nature. Natural history dioramas, in contrast, offer a scenario with a complete context in a named environment (ranging from the immediate location to scenes from other parts of world). It is a constructed representation with key concepts illustrated, and represents interactions and relationships between animals and/or plants, illustrates habitat characteristics, as well as adaptations and can even include human traces, such as cultural relics.

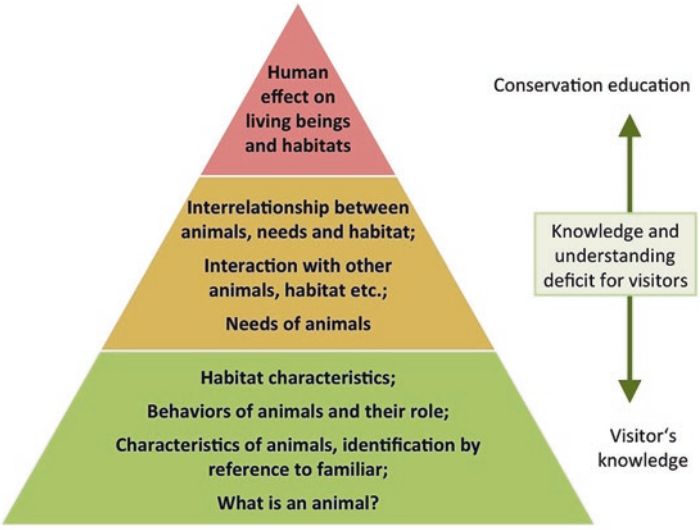

Fig. 11.1 "Conservation pyramid" representing a model for the progression of knowledge and understanding of concepts in biodiversity and conservation biology. (Tunnicliffe and Scheersoi 2009)

Our research has shown that dioramas attract a wide range of museum visitors and provide starting points to visitors' engagement through the recognition of familiar objects or by presenting intriguing situations (e.g. Scheersoi 2015; Tunnicliffe 2015). Specific diorama features support further knowledge acquisition, e.g. the dioramas' stillness with the opportunity to "stand and stare" (Tomkins and Tunnicliffe 2001), feelings of immersion (Bitgood 2014) and their narrative approach (Reiss and Tunnicliffe 2011).

Even if the original aim of most diorama designers was not to convey conservation messages, with the passing of time, these historic dioramas can enable visitors to recognize changes that have happened in the environment and stimulate them to reflect on why the changes may have occurred.

In former studies, visitors have been observed talking about conservation issues at dioramas (Scheersoi 2015). Such conversations were induced by different features of these dioramas that offered visitors the possibility to…

…see "flagship species" such as beavers or black stork who have almost disappeared in the presented environments,

…realize that the presented (mostly local) environments had undergone changes since the time of the diorama's construction (e.g. "The farmland diorama, there are lots of flowers. And when you look today, you do not even see a poppy anymore", cited from Scheersoi 2015),

…discover unexpected human traces in the presented environments, such as a beer bottle in an elk diorama at Frankfurt's Senckenberg Museum.

We therefore wanted to find out what kind of ecological information visitors grasp from dioramas and under which conditions they receive conservation messages inherent in natural history dioramas.

11.3 Methods

To answer to our research question, data were collected at a Natural history walk-through diorama at the Koenig Museum (Bonn, Germany) representing the African Savannah (see Fig. 11.2 for a plan).

Sometime before our study, thieves had broken into this diorama and had sawn off and stolen the rhino's horns. However, as the original horns had been taken away before this incident and stored in a museum safe to protect them from theft, the thieves just took away some copies made from plaster without realizing their mistake. The museum staff decided not to replace the horns but to present the rhino deliberately without horns (Fig. 11.3) to create encourage visitors' awareness and to foster their engagement with conservation concepts. A text label was provided to explain the issue.

During our study, two different text versions were tested: while the first text was quite plain and focused on the fact that thieves had been in the museum to steal the horns, the second version was carefully designed respecting the recommended

Fig. 11.2 Floor plan of walk-through diorama representing the African Savannah in the Koenig Museum (Bonn, Germany) ©ZFMK, U. Vaartjes

criteria for museum texts (e.g. Bitgood 2003; Screven 1992). It started with a short question as teaser, included a picture of the rhino with its horns and concentrated more on the demand for rhino horn. QR codes were used in this version to offer additional information about how to support conservation activities. The two texts were exchanged halfway through the study.

For our study, small groups of leisure visitors ($n > 130$) were observed (unobtrusive visitor tracking; the visitors were not aware they were being observed) and their spontaneous dialogues were captured by taking notes on a prepared observation sheet. The transcripts were analysed by establishing categories in relation to the progression levels in ecological concepts, as reflected in the conservation pyramid model by Tunnicliffe and Scheersoi (2009).

To find about the visitors' ideas and environmental knowledge, additional post-visit interviews were conducted (and audiotaped) with a smaller number of visitors ($N = 27$, in 11 groups).

Fig. 11.3 Rhino without its horns in the African Savannah diorama. (Photo: L. Weiser)

11.4 Results and Discussion

The results show that the diorama attracts visitors and provides emotional access to the themes presented: Many visitors are surprised by the size of certain animals like the kudus, the python or the giraffe. They also express their fear of dangerous animals like the lion or the scorpion or their disgust about the spider or the termites.

e.g.
Woman and child watching a film that is shown inside the termite hill (peephole):
Woman: "These are termites."
Child: "Do they live inside (the hill)? Yuck, disgusting!" (#79; Reference number for transcript)

Surprising details in the diorama (like butterflies sitting on elephant dung) or animals that are presented doing "interesting things", like some grooming apes or an impala that scratches its head with its hind leg, evoke positive emotional reactions like laughing.

e.g.
Child: "Wow, look at the zebra! Water is dribbling out of its mouth!" (…)
Man: "A drooler!" [the whole group laughs] (#75)

This is also in accordance with our interview data, showing that visitors are fascinated by the type of representation (diorama) and perceive the Savannah as ecosystem with its different components.

e.g.

Young woman: "Well, I realized that you see these different animals here that all belong to the Savannah. The natural world here just looks as if it was real, just as if it was here inside (the museum). The trees look so real, like in the desert, so dry. That's what I found really interesting." (Interview #3)

In relation to their knowledge in biology/ecology, the majority of visitors can identify elements within the natural history diorama. They identify certain species, often drawing on their previous knowledge, and comment on environmental elements such as dry grass (conservation pyramid, level 1).

"They look like chicken." (Guineafowls, #60)

"The stork also lives here in Germany." (#75)

"Look, we also have magpies in our garden. They steal the eggs from all the other birds." (Pied crow, #107)

"A deer!" (Antilope, #96)

"You see? There is a deer. (…) and a wild boar." (Greater kudu and warthog, #119)

"A coati, no – an anteater." [reads text label] "Oops, it's an aardvark!" [laughs] (#114)

"There is the eagle. On the tree. Maybe a baobab." (#58)

"It's dry, it is very hot here." (#102)

"Look, that's what a desert or savannah looks like!" (woman – presumably grandmother – to child, #65)

"That's what it's like… dry. The black spots – there has been a fire." (#75)

Due to the type of presentation (e.g. snapshot of animals in action; Fig. 11.4), visitors detect additional information about the animals' characteristics or behaviour.

Fig. 11.4 Snapshots of animals in action in the African Savannah diorama: Leopard (left) and Cheetah (right) (Photos: A. Scheersoi)

Man: "Yes, you are right, this is a cheetah."
Child: "Yes, and you can tell that they are really fast."
Man: "True, because it runs like that, right?" (#125; cheetah is shown running, hunting a warthog)
"Some animals take their prey into a bush, and the leopard eats on the tree." (#60)

Some visitors spontaneously discuss interactions and relations between animals and elements in the environment. They recognize social relationships (such as mother and offspring) or predator-prey relationships (conservation pyramid, level 2).

"Oh, they are prey." (termites, #45)

Child 1:"Grandpa, look, the butterflies – they are sitting on the elephant poop!",
Child 2: "A warthog." [points at it],
Grandfather: "Yes, the one running away from the cheetah is a warthog. And on the rhino's head, that's a bird." (#56)

Child "There is a small and a big giraffe.",
Woman (presumably grandmother): "Who is the big one?",
Child: "The father!",
Woman: "Yes, right." (#57)

Child: "This burrow is too small for warthogs.",
Woman: "Yes, but the cheetah cannot get inside. That would be good then."
Child: "Why?",
Woman: "Because the cheetah cannot eat it.",
Child: "Because it does not fit in there? But it is faster!" (#58)

"This is an anteater, and it makes holes in their house." [points at the termite hill] (#116)

"They delouse each other. Because of the lice. They take them out of their fur." (#126)

Man explains to child: "Look at the site of it (termite queen)! The whole day it doesn't do anything else but to eat and lay eggs. They live in the desert, it's so hot there that they build underground corridors, and these are ventilated by fresh air to cool it." (#97)

In spite of the cue provided by the museum (= rhino without horns), only few visitors spontaneously comment on conservation biology issues, such as changing environments due to human influence, e.g. extinction of species (conservation pyramid, level 3).

Woman: "Look, not even this rhino has got horns anymore. It's because animal welfare activists took many horns off to prevent rhino poaching." (#82)

The interview data reveal that many visitors seem not to notice the rhino, maybe because they do not expect such incidents:

I: "Did you reflect on themes such as human influence on nature or wildlife conservation when you were visiting this diorama?"
V1: "That does not really come up here, because all kind of species are present and human beings cannot be noticed, everything looks really idyllic. If there had been a street or a hut or something man-made, but everything is just like you would imagine it to be."

V2: "If they had thrown some Coke cans in here the theme would have been more present. Or birds exposed to oil or something like that. But everything here is very untouched, natural."

V1: "That's what one wants to see I guess."

V2: "Yes, such an idyll, maybe even cliché."

V1: "Indeed, pristine, in a natural state as it should be." (Interview #8)

Other visitors were observed to notice the rhino but they did not try to find an explanation or at least did not talk about it:

Child to woman (presumably grandmother): "Look at the rhino. Did they break it or what?"

Woman: "No idea." (no further response or action; #128)

Child: "Why are they missing, the rhino's horns?"

Woman: "I don't know." (no further response or action, #113)

One reason might be the fact that many leisure visitors come to the museum to have a pleasant (family) event and do not want to think or talk about serious issues such as animal poaching, especially if they are with children.

I: "Did you see that the rhino's horns are missing?"

V: "Yes [laughs], I saw that … But he [points at small boy] is still too young. I would talk about it with elder children." (Interview #1)

V: "I am here with my little son. I was thinking about how to explain all this to him. Then I just pointed at certain animals. The snake, and so on. (…) This is all very interesting, but he (son) is still too young." (Interview #5)

The following interview excerpts show that other visitors use their everyday knowledge to explain the missing horns and that their knowledge about conservation issues is often limited:

I: "Did you see that the rhino's horns are missing?"

V: "Yes. I thought what is that? Maybe repair work or construction works. Yes, that was… But what is it actually?" (Interview #5)

I: "Did you see that the rhino's horns are missing?"

V: "Yes, I saw it last time already. To be honest, I thought it was just broken. But of course, if I think about it now species conservation crosses my mind." (Interview #6)

I: "Did you reflect on themes such as human influence on nature or wildlife conservation when you were visiting this diorama?"

V: "Yes, even… I mean that rhino up here. It's like…I don't know if he was in an accident or something like this or something else that caused him to not have the horns. (…)

So yes, I was totally thinking about that. Maybe that someone broke it. Or was it meant to be that way?" (Interview #7)

I: "Why did you think that it was just broken?"

V: "In other cases it looks like a wound. If you… Well, I've seen it – when they want to hint at ivory poaching… it always looks really martial… That's why I thought that this here is maybe just repair work." [he laughs] (Interview #8)

In contrast to the above mentioned unambiguous diorama features in other museums that clearly hint at environmental issues and human influence on nature (e.g. beer bottle in the elk diorama), the missing horns in this study give room to different kinds of interpretation. They can be explained with repair or restoration work and do not automatically provoke thoughts about conservation issues. It became obvious that additional information is necessary in this case to prevent misinterpretations.

However, the given text explanation does not seem to provide a satisfying solution: The largest part of the visitors observed in our study, did not read the explaining text information. Even if visitors read the text, with the first text version, in conversations, they focused more on the fact that thieves had been in the museum and done useless illegal things rather than on the issue of rhino poaching.

After having read the text label (version 1), a man explains to a child what has happened.

Child: "But you are not allowed to step in here." [in the diorama]
Man: "Yes, but thieves don't care." (#38)

Child: "Why are the tusks missing?" [she points at the rhino, obviously meaning horns not tusks]
Man: "They have been sawn off. Some idiots have been in here and took them off without realizing that they were fake".
Child: "Did they sell them?"
Man: "Yes, they wanted to sell them but who buys plaster? You can get plaster for some cents at the building centre!"
Child: "You mustn't go in there." [she points at diorama]
Man: "No." (#97)

The second version of the text label that focuses more on the issue of poaching than on the theft in the museum, seems to trigger more thoughts and discussion about conservation issues, as some visitors stay for some time in front of the label and talk about the text's content (e.g. the use of rhino horn in the traditional medicine or the small remaining number of Javan rhinos).

e.g.:
Woman reads text label to a child: "Every 20 hours, a rhino is killed just for its horns because the price on the black market can be twice as much as GOLD [she repeats the sentence, again emphasizing the word "gold", then continues reading rest of the text and talks with disgust about the theft]. (#122)

However, the second version of the text is also only read seldom, and the QR codes (further information about rhino protection) were not used by any of the observed visitors.

Our data show that dioramas are attractive to museum visitors, and offer opportunities to grasp ecological information such as different types of biocoenosis or relationships between animal and plant species and their habitats. However, complex biological concepts are difficult to transmit. To stimulate visitors to reflect on conservation issues, such as human influences on nature and the extinction of certain species, specific and unambiguous cues are needed. The rhino without its horns

in our study, left room for alternative explanations (e.g. missing horns due to reparation works) and therefore led to misunderstandings instead of hinting clearly at the problem of rhino poaching. Additional text information did not solve this issue as most visitors did not read the text at all. This was also true for the second version of the text label that had been written and designed in accordance with recommended criteria (see above).

Experiences from other museums hint at successful alternatives: The cues provided in the diorama have to be either plain and easy to understand without any further explanation (such as the previously mentioned beer bottle in an elk diorama as a clear sign for human influences and environmental pollution) or surprising and perplexing in a way that the puzzled visitor will search for an explanation – and therefore also read texts. An example could be the intervention taken by the Powell-Cotton Museum (Quex) in their exhibition "Your last chance to see?" (see Chap. 12 in this book): the plight of endangered species has been highlighted through the use of coloured ribbons that were tied around the animals' necks in several dioramas. This action proved both popular and thought provoking amongst visitors.

Instead of text labels, new media might be a solution to offer additional information in an attractive way and thereby enhance biology learning at dioramas. Several museums are currently trying to integrate interactive devices into their diorama exhibits. In the Koenig Museum's new Rain forest diorama for example, film presentations, audio information as well as touch screens are incorporated to enhance environmental education and to inform visitors about complex themes such as pollination biology, parasitism, or species conservation. In Darmstadt (Hessisches Landesmuseum), tablets devices can be borrowed and used during the museum visit to receive additional information about the different exhibits, including the traditional natural history dioramas from the beginning of the twentieth century.

11.5 Conclusion

We conclude that visits to museums with specific habitat dioramas can increase visitors' ecological knowledge and awareness. In addition to explaining scientific facts and environmental problems, dioramas have the potential to connect learners to the natural environment and to evoke emotional reactions. Research found that such a kind of affective connection is a significant independent predictor of intentions to engage with the natural environment (e.g. Hinds and Sparks 2008). Museums, just like other informal education institutions, should emphasize conservation actions in their exhibitions and programs. They can offer "nature experiences" and help people to develop an environmental ethic by making the visit feel like an exploration into nature and create a sense of wonder about nature (Falk 2014). However, it has been shown that specific cues need to be provided in the diorama if visitors are to engage with conservation concepts. It also became clear that it is necessary to

carefully plan these kinds of interventions. Such cues have to be obvious, clear and easy to understand to avoid any misinterpretations. To be able to go deeper into a complex scientific topic, like conservation or environment protection, additional information is needed for the majority of visitors. Texts (and QR codes) are only read by a small number of visitors and therefore do not have the desired effect to inform visitors appropriately. Therefore, there is a need to explore in further studies which kind of media can be used to help visitors to comprehend the correct information and concepts.

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Chapter 12
Your Last Chance to See?

Keith Dunmall

12.1 Introduction

Natural History Dioramas are dramatic, yet static displays that are awesome in their impact and as created spaces described as 'art in the service of science' (Quinn 2006).

The dioramas of the Powell-Cotton Museum are stylised habitat displays containing representative samples of the flora and fauna to be found across Africa and in the mountains and jungles of northern and central India respectively. Built during the late nineteenth and early twentieth century they are the work of the explorer naturalist anthropologist and hunter Major P.H.G. Powell-Cotton and his family.

There was a desire among the museum staff for a temporary exhibition that recontextualised the dioramas with the present-day issues and concerns surrounding the 'habitats' represented. Biodiversity (Marandino et al. 2015) and climate change are key interpretive considerations in the use of dioramas as educational tools (Reiss and Tunnicliffe 2011). Discussions covered a range of topics including the desire to present habitat loss, climate change, poaching and trophy hunting. A frequent topic of debate among both staff and visitors was whether the museums founder was primarily a trophy hunter or a natural historian. A common response to the dioramas being a mocking 'no wonder they have gone extinct, he shot them all' (Summary of comments in Powell-Cotton Visitor book 2006–2014). In response to this often repeated interpretation, the core of the exhibition would be on extinctions.

The idea to develop an exhibition and intervention within the dioramas came from the Head of Education hoping to put education at the heart of an exhibition. This was a new step for a new team at the museum. Prior to the arrival of the Head of Education, learning at the museum had taken a traditional approach using a mix of trails, workshops and talks to share the messages of the history, geography,

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science and art of the diorama and other collections. Continuous development of the schools' programme between 2006 and 2014 increased the use of theatre and performance as the primary means of engagement (Dunmall 2015). This was still supported by the more traditional methods to enable students with a broader range of learning styles (Hawk and Shah 2007) to access the messages of the museum in a cross curricular approach (Barnes 2011). The benefits of a cross-curricular approach was a modular dynamic session structure that allowed students to direct the learning through questions, or through the spaces they choose to occupy in the museum acting as the stimulus for the content of the session.

12.2 Procedure

This approach, though effective and extremely student centred, requires knowledgeable staff and their presence during a session to enable the optimum benefit to be gained from the experience. In order to build upon the self-directed approach, a gallery was developed that housed collections, handling objects and the tools – computers, microscopes, measuring instruments and artistic resources – to enable any visitor to take on the role of researcher through self led or staff led sessions. This development however did not directly address the experience of learning in the dioramas.

Through self directed learning in the diorama galleries students would be able to choose their own interpretive pathway through the museum and, importantly, provide their own narrative for the diorama experience that was novel and relevant to their own learning. A direct intervention would provide the hook for the learning (Scheersoi 2015).

The initial suggestion was the complete covering or removal of the subject animals and in the case of removal, replacing them with cut out silhouettes to identify where they had been. In this way the intervention acts as the means of communicating the message – absence or absence from sight and in turn supported by supplementary rather than explanatory interpretation. Implementation drew on a team from four disciplines within the museum, each team member bringing different skills, insights, expectations and concerns. The team members were the Head of Collections, Head of Education, the Front of House Manager and the Marketing Officer.

The idea of working within the dioramas was not new to the museum. There had been previous interventions undertaken by staff and students from the Kent Institute for Art and Design during the curatorship of John Harrison (1997–2005). These were by and large artistic responses to the diorama and the museum in general.

From the collections perspective there was, as one would expect, a focus on the safety of the dioramas and the physical impact of the intervention. Being inside the dioramas and the associated risks and hazards both to the team and the exhibits shaped her contribution. Munsch et al. (2015) provide a detailed examination of the range of conservation concerns in Natural History Dioramas.

The Front of House Manager was an experienced biologist, conservationist and lecturer on environmental issues. His interest was both in the current taxonomy of the species represented and the hazards currently faced by these animals. He was also keen to develop a led walk through the museum for visitors to provide more information about the animals in the exhibition.

The Marketing Officer was eager that the exhibition was well advertised and hard hitting in order to draw the interest of the press. As the director of a conservation charity she was keen to focus on the impact of hunting. Beyond this she saw an opportunity to link the museum with the conservation charities working with the species in the collection, in particular to work alongside the Born Free Foundation to talk to a wider audience about conservation.

In order to provide a framework for the content of the exhibition the team quickly agreed that the IUCN Red List of Endangered Species™ would be used to identify the status of the specimens in the collection (International Union for Conservation of Nature and Natural Resources 2015).

The IUCN red list has a graded structure from those species of *Least Concern* to those that have become *Extinct*. Initially there was an expectation that due to Powell-Cotton's prolific collecting there would be many animals on display that were either Critically Endangered, Extinct in the Wild or Extinct. After an audit though there were surprisingly few that were listed as such and in order to have sufficient numbers to create an impact the criteria was extended to include those described as being Endangered and Vulnerable. The inclusion of the Vulnerable category was instigated by the Marketing Officer in order that the African Elephant could be included in the exhibition and use its status as charismatic megafauna to make the whole exhibition more appealing.

Beyond this there were many areas of discussion of the development of the exhibition that were not so easily resolved. The discussions and their influence on one another was subtle and in retrospect a difficult chronology to retrace. To that end this section will deal with each separately without noting these interactions unless they are of particular significance.

There is an interesting debate to be had about the effectiveness of bringing together diverse species to promote conservation messages through diorama that is not within the scope of this study. However to get that started consider both the conservation argument against it (Leader-Williams 2000) and the complexity of what holds peoples interest within a diorama (Scheersoi 2015).

During the team discussions it is possibly of interest the ideas rejected along the way to the exhibition. The subject that required most thought was how to indicate within the diorama that a specimen was on the list. Removing the specimen and replacing it with a black cardboard cut-out was quickly rejected, as was the idea to cover the specimen inspired by the Lionaid shroud campaign (LionAid 2015). It was then decided that a ribbon tied around the animals neck would work well. Discussions about a bow or not and then the possibility of it being knotted like a tie or a noose all led to the conclusion that there was an anthropomorphic element to these ideas that didn't quite work. Added to this there were some specimens where this would not be the most visible way of indicating their inclusion in the exhibition.

Fig. 12.1 The Jungle Diorama (left side), Gallery 3. Copyright Sarah Craske

Eventually with some continuing disagreement the decision was made to put the ribbon around the muzzle of the animals and hide the closure from public view. The ribbons were colour coded as follows to indicate the status of the animal on the IUCN Red List (Fig. 12.1).

Black	Extinct	EX
Purple	Extinct in the wild	EW
Red	Critically endangered	CE
Orange	Endangered	EN
Yellow	Vulnerable	VU

Once the physical intervention had been decided the next phase was to determine how to interpret the information we wanted to present. At the museum there are low level barriers/child height drawing ledges across the front of the dioramas with drawings and taxonomic and common name labels for each of the specimens in the dioramas. It was decided that alongside each of the animal names we would include a symbol to represent which of the eight key causes were a factor in the animal's status. These were:

- Climate Change
- Competition with Livestock
- Deforestation
- Disease
- Habitat Loss
- Human Encroachment
- Hunting
- Poaching

Fig. 12.2 Museum welcome space interpretation. Copyright Sarah Craske

The final symbol on the interpretation panels alongside these would be a two letter and colour coded square that repeated the colour coding of the muzzle ribbon that indicated the status of the animal.

A key at the entrance to the gallery was devised to draw attention to the whole exhibition and draw it to the attention of the general visitor. At over two metres wide and three metres high it dominated the entrance space to the museum (Fig. 12.2).

Taxonomy proved to be problematic as both the common names and scientific names for the specimens in the collection had changed since the time of their collection. This provided almost endless fun for the Front of House Manager as he worked through the 500 specimens on display.

Whether or not to produce a hand-out to navigate the six dioramas which held the interventions was a question that went back and forth within the group. In the end it was determined that we had put enough in place and should anything more be needed we would create it at that point. Once the exhibition was opened we quickly found that this was a necessary addition to the interpretation, and it took the form of a repeat of the large yet frequently overlooked information panel in the welcome space.

The press reception to the exhibition was boosted through a celebrity launch event. The museum Marketing Officer through her conservation work was in contact with Will Travers, Director of the Born Free Foundation, who opened the exhibition at the launch event and spoke on local radio and television about the exhibition.

Alongside him were students from a local secondary school who had previewed the exhibition and then also spoke on their findings. The transcripts of these talks are available through the Powell-Cotton Museum. This was a group who were frequent visitors to the museum and had previously discussed topics such as adaptation, camouflage and natural selection. In response to the installation the students spoke about their concerns for endangered species and the effects of climate change.

12.3 Results and Discussion

The 14 schools that visited during the exhibition also demonstrated a changed perspective through the intervention. The museum provided free introductory talks to every visiting school before during and after the exhibition. The questions asked and often answered by students before and after the exhibition tend towards the following:

"Are they real?"
"No, they are stuffed."
"They were, but now they are dead"
"They are hairy statues"
Why are they here?
"For us to look at"
"Because they were shot"
What is that in the tree?
"It's a basket"
"It's a fruit"
"It's a bird's nest"

During the period of the exhibition:

"Why have they got the thing on their faces?
"it shows they are endangered"
"it's where they were shot"
"It means they are extinct"

Fig. 12.3 The Desert Diorama, Gallery One. Copyright Sarah Craske

"Red ones (ribbons) mean endangered, are there any extinct ones?
"Yes, that one (points to the Scimitar Horned Oryx) with the purple band (Fig. 12.3).

Our visitor who were not part of a formal educational visit frequently expressed surprise at the number of causes of extinction. There was also surprise on examining the causes of the endangerment how little of it was due to hunting or poaching (including among some of the staff). There were even exclamations at some of the animals included as Critically Endangered. For instance, the African Wild Ass (Moehlman et al. 2015) drew particular attention as it was 'just a donkey'. The family group of Northern White Rhino proved a poignant display for some visitors (Fig. 12.4). Others didn't understand what the exhibition was about and were either redirected to the entrance of the gallery or brought one of the interpretation sheets created while the exhibition was running. Still others complained that the exhibition 'spoilt' the display.

This last comment also appeared in the museum visitor book which prompted an interesting response from another visitor. The second correspondent with an arrow to the first comment explained how important it was to show people about extinction.

The direct intervention had achieved the hoped for result by bringing a different set of discussions and conversations to the diorama galleries than those more typically observed (Tunnicliffe 2015).

Fig. 12.4 The Jungle Diorama (middle), Gallery Three. Copyright Sarah Craske

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Keith Dunmall has worked in education since 1995 using performance, writing and images, and other communication media. He has always considered clarity, suitability of medium, and memorability of message, central to his work. Recently completing an MSc. in Science Communication he is currently studying how to bring current research in museums to a wider audience. This truly behind the scenes activity is often little evidenced in museum public spaces, yet provides key insights to scientific processes and the issues surrounding scientific research. He believes better public understanding of these processes and issues through museums is important to informed decision making.

Chapter 13
Teaching and Learning Biodiversity with Dioramas

Martha Marandino, Juliana Bueno, Marianne Achiam, and Carolina Laurini

13.1 Introduction

Natural history museums are historically places that collect, conserve, research and disseminate aspects of the diversity of life. Facing the biodiversity problems that have become acute in recent decades, museums are called upon more than ever before to propose strategies that help tackle conservation challenges. In addition to their traditional functions related to collections and research, museums' education and communication initiatives are thus increasingly focused on biodiversity and its preservation.

Biodiversity represents a unique challenge for education. The general public seems to recognize the term "biodiversity" even though their knowledge about it may be simplistic or confused. Recently, a study was conducted on public opinion about biodiversity by the Biodiversity Barometer (2009–2015) from the Union for Ethical BioTrade (UEBT 2015). It was carried out from 2009 to 2015 with 47.000 consumers in 16 countries (USA, Mexico, Colombia, Ecuador, Peru, Brazil, UK, Netherlands, France, Germany, Switzerland, China, India, Vietnam, South Korea and Japan). The results indicate that the term "biodiversity" was relatively well known among respondents, and that a growing number (although in all cases less than 50%) defined biodiversity as the variety of plants and animals. Some

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respondents gave examples of ecosystems (e.g. the Amazon), or of the danger of monocultures. Others confused biodiversity with organic agriculture, environmental protection, global warming, or environmentally friendly products and technologies. Biodiversity was considered to be essential for one out of every two people interviewed in nine of the countries and for 74% of the respondents from Brazil, Ecuador, Mexico, and India.

> Many respondents around the world are familiar with biodiversity, particularly in Latin America and Asia. Yet, the meaning of biodiversity is not well understood still: on average 1 out of 3 could provide a correct description. While awareness and understanding of biodiversity are slowly growing, governments will need to step up efforts to increase awareness among their citizens to reach the 2020 targets of the United Nations (UEBT 2015, p.3).

Another important finding of the study is that TV and radio programs, school, and newspapers and magazines are the main sources of awareness of biodiversity, with differences in the order of importance per country. These findings prompt us to consider the role of museums in promoting an effective comprehension of biodiversity.

The diversity of meanings held by the public of the term biodiversity is a particular challenge for the field of education (Gayford 2000; Weelie and Wals 2002). Several authors have emphasized the importance of developing this subject in schools and the necessity of changing the relationship between humans and the environment (Gayford 2000; Vilches and Gil Peres 2003). In addition to school, other educational environments such as museums are called to collaborate in this effort (Brown 1997; Mehrhoff 1997; Davis 1999).

Today, museums are important educational resources, and one of their biggest challenges is to exhibit and disseminate issues related to biodiversity to arouse interest in visitors and improve their understanding and their attitude toward conservation. Exhibitions are the most important and well-recognized communication and education media in museums (Van-Praët and Poucet 1992; Dean 1994; Marandino 2005), and throughout their history, different perspectives have influenced the way organism diversity has been exhibited in natural history exhibitions. From a *biocentric* perspective in which nature was understood simply as its collective biotic and abiotic components, the development of the conceptions of ecology and ecological communities promoted a new way of representing biodiversity. Between the nineteenth and twentieth century, this *eco-centric* perspective influenced exhibition practices. Dioramas appeared that illustrated the natural interactions between the plants, animals, topography, and climate of a given environment. In the late twentieth century, anthropogenic impacts on the natural world began to be felt and prompted concerns about loss of biodiversity, climate change and conservation. As a result, in the beginning of the twenty-first century the *anthropocentric* perspective began to influence representations of nature and the relation between organisms and human beings in exhibitions (Fortin-Debart 2003). Knowledge about conservation and the role of humans in both causing problems and effectuating change began to be more explicitly represented and discussed in museums.

Even though the way biodiversity was represented changed substantially during this period of time, it continues to be a relevant issue in museum exhibitions and

essential content for museum education and science communication activities. As discussed by Krishtalka and Humphrey (2000), natural history museums face a number of fundamental challenges for the twenty-first century related to both collection and education. Natural history collections represent the three-dimensional historical records necessary to understand biological diversity and sustain plants, animals, microbes, and natural environments. It is thus crucial to promote museum dissemination such as exhibitions and educational programs that engage people in becoming the environmental conscience of their respective nations.

The subject of biodiversity seems to fit well with certain kinds of displays such as dioramas and immersion exhibits. Dioramas, conceived as scenarios that simulate a natural environment with models or taxidermied animals and plants, are the traditional way to explore ecological ideas in museums, because they allow the audience to perceive the relationships between the flora and fauna of an environment. As Morris (2009) elaborates, good dioramas embody information about ecological context, habitat, behavior, structure, and movement; this means that dioramas have considerable potential to transmit messages. Furthermore, dioramas are considered as important teaching objects in museums, especially with regards to biodiversity-related content (Bueno 2015). In the following, we shall discuss this diorama content in terms of *expositive discourse*, namely the narrative that emerges from the staging of the content. We shall discuss what the audience understands about biodiversity when they interact with dioramas, and what kinds of biodiversity-related knowledge they acquire when they are contemplating dioramas in museums.

In the following, we share empirical results from a program of research developed in partnership between the University of São Paulo, Brazil and the University of Copenhagen, Denmark. This partnership focuses on the analysis of teaching and learning processes in museums, and is the basis of the work presented in the first Springer volume on natural history dioramas (cf. Marandino et al. 2014). In the present text, we elaborate and expand on some of the findings discussed there.

In the first part of our account, we discuss the potential of dioramas to represent and teach aspects of biodiversity. This discussion is based on a thorough analysis of the biological content of the Amazon Forest diorama from the Zoology Museum of the University of São Paulo. In the second part, we share the results of a study of the biodiversity-related knowledge constructed by adult visitors while visiting dioramas, both at the Zoology Museum of University of São Paulo (ZMUSP) and the Zoology Museum of the University of Copenhagen (ZMUC). Finally, we discuss more generally the potentials and challenges of teaching and learning biodiversity using dioramas in museums.

13.2 Methodological Aspects

The analysis of the Amazon Forest diorama in the Zoology Museum of the University of São Paulo was based on museum documents, observations, and interviews with exhibition designers and the audience (Bueno 2015; Bueno and Marandino 2017).

The analysis was structured by the Anthropological Theory of Didactics (ATD) in order to identify aspects of biodiversity that are present in the diorama, especially in the objects, text, and supporting images. Specifically, the notion of praxeology was used as a tool to identify and understand the elements related to ecology and biodiversity presented in the Amazon Forest diorama, as well as how the visitor's acquisition of those elements was intended to take place (cf. Mortensen 2011; Achiam 2013). This analysis allowed us to identify the *tasks* embodied in the design of the diorama, as well as the *techniques* proposed by this design. These two elements comprise the practical component (or *praxis*) of the praxeology related to the diorama; that is, they describe the perceivable characteristics of the diorama and the actions afforded to visitors by those characteristics. Furthermore, we identified the cognitive components (or *logos*) of the praxeology related to the diorama: The *technology* (or discourse about the technique) describes the ways the interaction with the diorama can be understood by a visitor in relation to biodiversity, while the *theory* component comprises the more overarching inferences about biodiversity that can be made. In this chapter, we will present results from this praxeological analysis, illustrating which concepts and ideas of biodiversity are shown in the diorama, and how those concepts and ideas can be taken up by visitors. In other words, the praxeological analysis presented here serves to clarify the potential of the diorama of disseminating biodiversity to visitors.

The second study we refer to here focuses on adult visitors to dioramas in two zoological museums, the Zoology Museum of the University of São Paulo and Zoology Museum of the University of Copenhagen. We collected data from 15 adult subjects from Brazil and Denmark. In each museum, the subjects observed two dioramas, while at the same time verbalizing their thoughts (the *thinking aloud* method). The observation session was followed by a semi-structured interview. Both the thinking aloud session and the interview were audio and video recorded. This method is based on research on psychology (Ericsson and Simon 1993) and has been adapted to study learning in a museum (Dufresné-Tasse et al. 1998; Émond 2002). In the present case, it was used to understand what kinds of biodiversity-related knowledge the adult audience constructed when observing dioramas. The analysis of the data collected in this way was guided by the categories of approaches of biodiversity (Marandino and Diaz Rocha 2011), namely *levels of biodiversity organization*, *biogeography*, *evolution*, *conservationist* and *human*. The definition of each approach is set out in Table 24.1 and is based on discussions about the aspects involved in the idea of biodiversity and biodiversity education (Levêque 1999; Gayford 2000; Weelie and Wals 2002; Brandão 2010).

13.3 Dioramas as Teaching Objects in Museums

As described in the preceding section, dioramas are carefully constructed scenarios that have been used in museums since the nineteenth century to promote a realistic perception of nature. To this end, dioramas combine reproduction techniques with

Table 24.1 Approaches of biodiversity

Categories of approach of biodiversity	Description
Levels of organization	Biodiversity is expressed in terms of levels of organization, related to species (taxon variety), genetic (gene variation between individuals, population and taxon) and ecosystem (taxon variety and the environment where they lived).
Biogeography	Biodiversity is expressed with emphasis on the time and space dimensions, including the organism's distribution in a period of time or geography.
Evolution	Biodiversity is expressed with emphasis on the time dimension and the variation of one or more groups of organisms during a period of time, establishing relations with an ancestor.
Conservation	Biodiversity is expressed with emphasis on the implications about the species conservation and the environment threats.
Human	Biodiversity is expressed with consideration of the human dimension. This approach can be presented in two forms: the human being as a species like any other biological species; or as a central species, considering cultural, social and economical aspects. In the latter case, there is no relation with conservation aspects.

scientific knowledge of plant and animal species. They make use of lighting effects, painted backgrounds, and taxidermied plants and animals. They present a type of motionless theater, which places us in make-believe habitats that function by creating a degree of realism (Almeida 2012). Dioramas can be understood as objects produced with the intent of teaching and learning in museums; indeed, their institutional longevity seems to attest to their efficacy as educational devices (Van Präet 1989).

The biological knowledge embedded in dioramas is usually connected to the observation, identification and recognition of species of plants, animals or fungi, the relationships of these organisms with each other and with the environment, and also the identification of geophysical phenomena such as rock formations, soil types, types of biome, and others. Therefore, dioramas can realistically illustrate both flora and fauna of different biomes in terms of the different adaptations of the animals and plants living in these environments. Moreover, dioramas can represent different ecological relationships, including the symbiotic relationships among living creatures. They are therefore particularly effective with regards to disseminating knowledge about different habitats and the interactions between organisms. Dioramas are potentially powerful tools for science education and should be developed as such (Tunnicliffe 2009).

In recent years, studies of dioramas have focused on how they represent different habitats (Insley 2008), meaning that the dioramas have historically been, and still are, used to represent realistic scenarios consisting of natural specimens and at the same time also to showcase the skills of taxidermists. They thus offer visitors new, image-mediated learning experiences which, according to Hooper-Greenhill (1990), are the most concrete medium for learning. Paddon (2009) adds that dioramas can provide valuable opportunities for education in museums, because in addition to

their visual qualities and learning, dioramas may also offer opportunities to interpret historical collections, mappings and, for example, 'the story of taxidermy'.

A number of studies have explored the potentials of dioramas to elicit educational activities in science museums (Ash 2004; Tunnicliffe 2009; Bueno and Marandino 2017). These studies emphasize the potential of dioramas to promote the understanding of ecology, biodiversity, and conservation issues by allowing visitors to observe environments they have never before experienced. Thus, in our view, dioramas are educational objects, meaning that they are created by combining scientific, artistic, education and communication knowledge into one product. Dioramas are objects that demonstrate the contents and actions intended by their designers and producers; thus, it is possible to study how dioramas address biodiversity as a means to characterize their potential to disseminate this theme in the museum.

13.4 Teaching Biodiversity with Dioramas in Museums

Dioramas, like other educational objects, are the results of human efforts. They result from processes that include simplifications and reductions but also enrichment and reconstruction; these processes are governed by the intended learning objectives of their designers. To understand how dioramas represent knowledge in museums, we draw on research into the representation of biodiversity in a variety of exhibitions in museums, science centers and aquariums (Bueno 2015; Marandino et al. 2014; Salgado 2011; Marandino and Diaz Rocha 2011; Oliveira 2010).

Oliveira (2010), for example, studied the transformation process of biodiversity idea that occurs in dioramas production – museographic transposition – in two Brazilian museums, considering not only conceptual dimensions of biodiversity but also value dimensions. This work showed how aspects related to the *species* and *ecosystems* levels of biodiversity are strongly present in dioramas. Oliveira also found that aspects related to *values* of biodiversity are less present in dioramas, but that they emerge when a diorama explicitly explores conservation themes.

More recently, a number of studies of *praxeologies* in museums have emerged. The focus of these studies has been the learning environment of museum exhibitions; specifically, these studies have sought to understand the relationship between design and learning. This understanding, in turn, has been used to generate theoretically grounded yet operational principles for optimizing the alignment between the design of exhibitions and the educational outcomes (Mortensen 2010; Achiam and Marandino 2014). Using the potential of this approach to describe diorama contents, Bueno (2015) analyzed the Amazon Forest diorama, an element of the thematic area "Neotropical Fauna and Marine Environment" of the exhibition "Zoology Research: Biodiversity under the view of the zoologist" of the Museum of Zoology, University of São Paulo. This analysis included the diorama and its supporting elements (e.g. the display case and the panel containing text, image and layout with subtitles; see Fig. 24.1), and aimed to give a detailed description of what and how a diorama represents biodiversity concepts.

Fig. 24.1 Front view of the "Amazon Forest" cluster of ZMUSP

To systematically describe the diorama, a focal question was chosen. This focal question served to orient the investigation of what and how biodiversity was represented. The question "How can the visitor perceive the ideas and concepts of biodiversity represented by the diorama of the Amazon Forest and its exhibition set?" helped to describe in details each element, using the theoretical framework of praxeology.

The diorama of the Amazon Forest has an "L" shape, and is about 3 m high, 4.5 m long, 2.4 m wide at the wider part of the "L" and 1 m at the narrower part. The display is open and has guardrails. Light sources are located at the front and directed towards the rear. The diorama includes taxidermied animals, models of flowering plants, and trees. One of the supporting elements of the diorama, the display case, is 50 cm from the floor and consists of three glass covered, backlit boxes. Two of the boxes include invertebrates and the third has a legend to identify some of the vertebrates in the diorama. Another supporting element of the "Amazon Forest" cluster was a panel, including a text, an image, and a sketch with a legend, which together displayed the characteristics of the Amazon Forest. In order to describe the diorama according to the notion of praxeology, a thorough documentation was carried out to reveal the ideas and concepts expressed in the whole cluster. An example of the description is given in the following:

> In the 2nd quadrant, in the center, there is a cut tree trunk with ferns, vines, a pink orchid in tree trunks. At the bottom, on a branch of the cut trunk, there is an iguana *(Iguana iguana)* with its tail extending to quadrant 1. The soil is sparsely covered by shrub vegetation – 20 to 30 cm high – with some elevation representing rocks or exposed plant roots (Description of a part of the Amazon Forest diorama/ZMUSP).

The description represents a translation of the elements presented in the Amazon Forest diorama into text, and outlines the ideas and the elements that define and operationalize the design of the exhibition in order to communicate the contents of biodiversity to the visitors. Considering the focal question "How can the visitor perceive the ideas and concepts of biodiversity represented by the diorama of the Amazon Forest and its exhibition set?" we observe that the visitor has the opportunity to recognize the diversity of species and ecosystems of the Amazon Forest. This idea is expressed in a specific way, because the diorama represents an ecosystem composed of different environments, with great plant and animal diversity. Also, with the help of the panel, the cluster represents the geographical distribution, and the threats this ecosystem is currently subjected to.

Each element of the rich object that is the diorama potentially supports a multitude of ideas and concepts. From the visitor's perspective, the diorama presents them with a variety of tasks. For example, the diorama affords the visitor a view of a complete scenario; in other words, the visitor may perceive the *tasks* of observing the entire scenario, identifying the environment and the organisms distributed within it, at the same time recognizing and discerning aspects as ecological relationships of the Amazon Forest, the plant and animal richness of this forest or the species that compose the animal diversity of the Amazon Forest. Regarding this last aspect, the visitor may identify this diversity by discerning an iguana and a pink orchid, or by looking into the glass covered boxes with specimens of the insect, arachnid and crustacean diversity, as illustrated in Fig. 24.1 of the Amazon Forest cluster.

Bueno (2015) found that most of the tasks identified in her analysis were related to the action of identifying organisms in the scene, as in the task "distinguish organisms that contribute to Amazon Forest diversity". It was interesting to note that the diorama is conceived as an *object to show objects*; in the present case, the displayed objects are those organisms that can be found in the Amazon Forest, and the diorama seemed to be well-suited to accomplish this goal. Further, Bueno concludes, the diorama is a suitable medium to help visitors to perceive ecological relations between species and the environment. Because the species in question are static, the diorama offers the visitor the opportunity to stop, look, observe, visualize, find, identify, recognize, discriminate, suppose, and search for their questions in a different way than in a zoo, for example, where animals are alive and exhibit behaviors that may make observation difficult.

However, Bueno's study also observed that very few diorama tasks gave rise to complex mental operations. To the extent that the visitor was able to see and identify biodiversity elements by observing the diorama, they typically named and pointed out the organisms and their relations. In these cases, tasks and techniques related to technologies such as inferring and supposing were less frequent in the praxeology analysis. Such technologies were rarely prompted by the tasks and techniques

embedded in the cluster of the Amazon Forest. This, of course, has implications for visitors, for whom opportunities are lost to compare morphological and functional characteristics of species in the different habitats. Such comparisons could potentially reveal the complexity of species' behavior and of the idea of biodiversity itself.

Another important aspect of the Amazon Forest cluster is that it presents contents related to biogeography, such as data about clime, rainfall rate, deforestation (and, conversely, the preservation of forest), and also the location of the biome on the world map. However, whether the visitor grasps these contents depends on the type of interaction established with the exhibition, because the visitor would need to look at the panel and read the information on it.

Clearly, the praxeology framework helps to detail the concepts shown in the cluster of the Amazon Forest diorama and reveals the potential of the diorama to disseminate ideas of biodiversity in an objective way. Further, the analysis helps identify which aspects of biodiversity are privileged and which are absent or deliberately removed from the diorama when it was produced. This information was available from observations, the documents, and the interviews with the designers of the exhibition, and provides the basis for an evaluation of the dissemination potential of the diorama in a museum.

Recently, the notion of praxeology was adapted to be used by museum educators or schoolteachers to improve the learning process in museum settings (Oliveira et al. 2015). The approach used praxeology as a framework to describe the scientific concepts and ideas present in an exhibit in a museum (such as a diorama), and to identify the techniques used to represent those concepts and ideas. The description made by the museum educator, the teacher or even the students helps to identify the theory, technology, techniques, and tasks presented in the object. With these elements in hand, it is possible for educators and teachers to design a teaching sequence that can be carried out during visits in museum exhibitions.

13.5 Comprehension of Biodiversity from Dioramas in Museums

In order to understand the role of museums in disseminating aspects of biodiversity to adult audiences, we carried out a study of what adult visitors observe and talk about when interacting with dioramas. As mentioned previously, the collected data consisted of two parts: thinking aloud (when the visitor says what comes to their mind while looking at the diorama), and the subsequent interview. This data was analyzed using the categories of approaches of biodiversity (Marandino and Diaz Rocha 2011), related to levels of biodiversity organization, biogeography, evolution, conservationist and human.

The categories of approaches of biodiversity have been used previously to identify the biodiversity content presented by in museum exhibitions (Marandino et al.

2009; Monaco and Marandino 2010; Marandino and Diaz Rocha 2011). The data from those investigations, which analyzed five museums: three Brazilian, one French, and one Canadian, reflect similar patterns: The perspective of *levels of organization* is represented most frequently, especially in particular the species and the ecosystem levels, whereas the genetic level is often absent. Aspects of biogeography and evolution are present but infrequently, mostly cited in panels or labels. The conservationist approach appears in some cases in the exhibition narrative, represented by a threatened species for example whereas the *human* approach was very rare. Both of the latter approaches were more frequently present in the immersion exhibitions studied.

But what kinds of biodiversity knowledge does the audience acquire during their visits to dioramas? The literature reveals that a visitor, when observing a diorama, constructs a particular narrative that adapts what they see to their previous knowledge of the environment and the displayed organisms (Piqueras et al. 2008; Tunnicliffe 2009). In our research we analyzed the narratives of visitors, searching for evidence of the approaches of biodiversity presented in them. We noticed that some approaches of biodiversity are more common in visitors' perceptions than others. For instance, all the observed subjects spoke about the species they observed in the dioramas, making the approach of *levels of organization* the most strongly present in the verbalizations, both in Brazil and in Denmark. In particular, the *species* level is recurrent, as for example when the visitors identified and named the organisms in the scene during the thinking aloud data collection:

> How many plant species, here we observe many trees, there are also lianas, where some animals, we also see ferns, plants (ZMUSP).

> I've never seen pelicans in Denmark, so I did not know we had them here (ZMUC).

The *ecosystem* level is also expressed in the verbalizations of the adult visitors, but less frequently than the *species* level, as seen above. The *genetic* level was not found in the data; that is, the visitors did not make any comments related to the characteristic variations between individuals, populations or taxa.

> Well, it's ecosystem … peace, ah … power … dense forest, diversity in fauna and flora, a large trunk trees … a rainforest. Interaction of the environment, the animals are interacting, less the jaguar, the jaguar seems mad at someone who is coming, are the human? … Collectors animals in the case squirrels, … vines, … means it is a hawk feeding a monkey, predator, …, has a bio-indicator, also in … the vine trunk, oxygen bio-indicator, are the lichens, um … a den, a house, a monkey, here is a lizard, a chameleon in search of sun (ZMUSP).

As we know, the behavior of identifying and naming organisms during an exhibition visits is common (Allen 2002; Tunnicliffe and Scheersoi 2009). In such instances, the visitor emphasizes the *species* approach of biodiversity. It thus seems that dioramas are efficacious media for promoting this kind of interaction, especially when the diorama affords the perception of the species that belong to a specific ecosystem. Also, identifying relations between different species, and between species and the abiotic environment, characterizes the level of *ecosystem* organization approach, which arguably has been the role of dioramas since their

origin. The aspects related to the level of *organization* were verbalized spontaneously by the subjects during the thinking aloud method but also discussed during the subsequent interview.

The *conservationism* approach was also present in our data, suggesting that the diorama scenario can create a link between the audience and discussions about environmental threats. This may occur even if the scenario does not address a specific environmental problem, as we can see in the verbalization of the subject from the Zoology Museum of University of Copenhagen, when they speculated about the objective of displaying a present-day beech forest in a diorama. Also, the visitors offer their own knowledge or alternatively, information collected during the visit to speak about this theme, what is promoted by the object observed in the scenario. This occurred both during the thinking aloud and the interview:

> (…) It is something about how much forest we have in Denmark, when we had it and how much we have, how many trees were planted and learn a little (ZMUC).

> The jaguar is an endangered animal, so it has a certain appeal, and being endangered, we already think, reflects on the degradation of the environment (ZMUSP).

The *biogeography* and *evolution* approaches of biodiversity were also mentioned, but in relatively few instances, compared with the other approaches. Generally, these topics were mentioned during the interviews, when we asked visitors about what they thought was the learning objective of the dioramas. However, it is important to highlight that aspects of the *evolution* approach were present only at ZMUC; this occurrence is almost certainly related to the overarching theme of the exhibition which was "The Danish Fauna throughout 20,000 years: From Mammoth Steppe to Cultural Steppe".

> I would say I should learn something about when I find it. I must learn about what happened seven thousand years ago, because of this,… that I'm exactly in this area of the museum, you can see from the beginning and when the period comes close today. I would say that's why I stopped and looked in those scenarios, where the animals were living at that time (ZMUC).

> Yes, looking at this diorama now there are animals that we have now and there are others we do not, you do not find those animals anymore. Then I would expect that represents an environment that exists before (ZMUC).

The *human* approach was present neither in the thinking aloud, nor the interviews. In the example shown below, a visitor comments that in a preserved environment, humans cannot be present.

> And it's the preserved environment, right. Preserved, … man is not present (ZMUSP).

We consider that in this case, the focus is on the *conservationism* approach and not the *human* approach, as the visitor is not discussing the role of the human being in preservation or considering cultural, social and economical aspects of the biodiversity.

Our data allow us to discuss aspects about what approach of biodiversity the dioramas focus on. We are able to affirm that the *level of organization* of biodiversity is frequently perceived when adults observe naturalistic dioramas in the studied

museums. The *species* level is strongly present in the verbalizations of the audience; the *ecosystem* level is also present but less frequent. The *genetic* level was absent: it was not identified when adult visitors observed the dioramas.

In relation to the other approaches of biodiversity, the *biogeography* and *evolutionary* approaches were identified in a smaller number of verbalizations, just as the *conservationism* approach. The *human* approach was not identified.

These results indicate that the studied naturalistic dioramas are very efficacious devices for audiences to learn about the *species* and the *ecosystem* levels of biodiversity organization; further, they may be suitable for visitors to learn aspects of *conservation*, *biogeography* and *evolution* concepts of biodiversity, considering the previous knowledge of the visitor and the information given by panels and labels. However, dioramas do not seem to be effective prompts for discussions of the complexity of biodiversity, a complexity that includes the role of the human in preservation and human biodiversity itself.

13.6 Discussion and Conclusion

Dioramas are effective devices for the dissemination and acquisition of knowledge in museums. Moreover, they are well suited for teaching and learning some aspects of biodiversity. Like other educational objects, they are created through a process of simplification and reduction in order to organize and select information according to educational and communication goals. Our analysis elucidates the final product of this process and its potential to disseminate important biodiversity content. But is also true that there are limits to the complexity of biodiversity content that can be expressed through dioramas, at least with the present genres of naturalistic and classical dioramas still featured in many museums.

The use of praxeology as a theoretical and a methodological tool was an effective means to identify the biodiversity concepts in dioramas. The praxeological characterization of the diorama helps to identify the elements that define the design of the exhibit as well as the operationalisation of these features in the communication of biodiversity content to the visitors of the cluster of Amazon Forest diorama. In terms of dissemination potential, this cluster is composed of many different types of tasks, expressed in a variety of modalities: a scenario with taxidermied animals, models of plants, display cases, panels and labels with text and images, and interpretative schemes to be observed and read. Many concepts, related to different aspects of biodiversity, require interpretation by the visitor. The praxeological analysis revealed several tasks that could allow the visitor to perceive the characteristics of the environment and species, their behavior, and the distribution of organisms in the space.

It was noted, however, that there was a prevalence of tasks that prompted the visitor to simply identify animals in the scene. Even though the Amazon Forest cluster shows elements that go beyond the field of biological concepts, including contents from other areas of knowledge such as biogeography, it does so with the help of panels with text and images. As stated previously, those contents will be appre-

hended by the visitor strictly depending on the type of interaction that is established with that information. Nevertheless, dioramas still have a powerful role to play in helping visitors understand biodiversity and the ecological relationships between organisms and with the environment, because they have the potential to reach a wide audience, thereby expanding access to biological knowledge. Many cognitive tasks are posed to the visitor during their observation, namely identifying, recognizing and distinguishing elements that belong to the ecosystem in question. The educational intention of the diorama is therefore substantial; even though it seems a totally static object, the diorama embodies an interactive quality, further strengthening its educational role. This trait resides in the potential of the diorama to 'lead' the visitor to the natural environment to which it represents, and to reveal behaviors, dynamics and relationships that occur in those environments.

Thus, the results related to the praxeological analysis reveal the potential and the limitations of dioramas for disseminating biodiversity in museums. Of course, not every concept and idea can be shown in an educational object; choices must be made to select what and how to disseminate using a particular medium. This selection process explains the absence of some ecological relationships, some animal classes, and some plant species. Also, it is noted that certain cognitive tasks are not frequently present in the praxeological analysis of the Amazon Forest, related, for example, to the ability of compare morphological and functional characteristics of the species and habitats (Bueno 2015).

In our studies of the adult audience visiting dioramas, the same characteristic was noticed. Visitors frequently discussed species and ecosystem characteristics (*levels of organization* of the biodiversity), *conservation*, *biogeography* and *evolution* aspects (when they are mentioned in panels and labels), and very rarely discussed the *human* approach of biodiversity. They did not consider the complexity of biodiversity, which includes the role of the *human* in the preservation and the human diversity itself. This finding is corroborated by Campos (2013), who found that most adult pairs observing and talking in front of the same Amazon Forest diorama used cognitive operations such as naming and pointing; affective comments and characterization of the elements were also frequent whereas the mental operations of supposing and explaining were very rarely present.

It is clear that dioramas are suitable objects for disseminating certain aspects of biodiversity, but not all of them. However, the dissemination potential of dioramas could be improved depending on the communication devices and the mediation strategies supported by the museographic elements. The process of teaching and learning in museums involves the personal context, the sociocultural context and the physical context (Falk and Dierking 2000). Regarding this last aspect, topics such as the orientation to the physical space, the architecture, the environment, the design of exhibits influences individually and collectively and significantly contribute to the quality of a museum experience (Falk and Storksdieck 2005). Taking this statement together with our data, we observe that to improve the visitors' comprehension of the complexity of biodiversity using dioramas, it is necessary to implement strategies that suggest tasks and techniques beyond those already present; only then will visitors be prompted to move beyond simply identifying and naming species and ecosystems.

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Chapter 14
The Relevance of Natural History Dioramas for Sociocultural Issues

Michael J. Reiss

14.1 Sociocultural Issues and Biology

For much of its history, biology generally saw itself as an objective science, immune (or striving to become immune) to the vicissitudes of culture. Indeed, biologists have often looked towards physics as the ideal science with its allure of precision and elegance – somewhat ironic perhaps, given that twenty-first century physics, particularly quantum theory and chaos theory, helped reveal the extent to which science is not deterministic.

Despite this, professional biologists have tended to react with incredulity or scorn to attempts by major authors such as Donna Haraway (1989/1992) in her *Primate Visions* to dissect the extent to which biology is affected by society. The reality is that biology – and this is true of natural history dioramas as much as of primatology – inevitably becomes constituted by the values and cultural dimensions of the societies in which it arises and is practised. This is not, of course, to deny that biology has a close relationship to reality but the relationship is not a straightforward, linear one. Society affects biology and biology affects society (Reiss 2000).

What is true of sociocultural issues and biology is even more true of sociocultural issues and natural history dioramas. The chapters in this book begin to explore the implications of this. In some cases, notably Doris Ash's chapter, the exploration is explicit and detailed. In others, the exploration is at an earlier stage and more tentative. But this is not a project that will be completed soon. The challenge for those who construct natural history dioramas and for those who use them in education is to engage visitors and to help them learn about biology, about their society, about culture and about themselves.

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14.2 Natural History Dioramas and Sociocultural Issues

In Chap. 2, Eirini Gkouskou and Sue Dale Tunnicliffe note that visitors come to dioramas for a wider range of reasons. Using interviews and questionnaires they explored visitor intentions at the Powell-Cotton Museum in southern England. Perhaps unsurprisingly, and in line with earlier work undertaken by one of the authors (Tunnicliffe 1995), Gkouskou and Tunnicliffe found that the richest responses to the diorama came from older visitors. Pensioners talked of their memories and how these connected with the dioramas – with a number, for example, talking of how the diorama brought back memories of their having lived in or visited Africa.

Maritza Macdonald, Roberta Altman and Jay Holmes in Chap. 3 discuss their collaborative work as museum educators who work at the American Museum of Natural History (AMNH). They present a composite of strategies and assignments for museum-based courses given, over the past 5–8 years, to teachers (and those training to be teachers). The course on which they focus in their chapter introduces teachers to use museum-developed resources to supplement their teaching strategies and knowledge of content.

After teachers have done some readings on how learning takes place in museums, they are invited to do an open-ended walk through the Hall of North American Mammals at the American Museum of Natural History in New York. Their only directive is to explore the question: "How or why may you use this exhibit with newcomers enrolled in Earth Science courses?". Initially, some teachers are sceptical about the worth or even the possibility of such activities. Comments such as "Why are we looking at these mammals? I teach kids from all over the world and I need to focus on Earth science concepts and content related to the Earth Science exams in this country", "My new immigrant city kids will never see these animals or landscapes" and "This would make sense if I was teaching social studies" abound.

Given time, and some gentle questioning from those teaching the course, the tone and content of the teachers' comments move away from a deficit model towards a more inclusive one, for example "Look at this armadillo, I bet some of my Mexican students will recognize it" and "Are these animals real or stuffed? I think that I would love to have the time to teach kids how to make dioramas. My daughter made one in her private school using shoe boxes".

Later in the course, the teachers undertake projects with their students. One of the most interdisciplinary projects was *The Travel Agency* in an eighth-grade classroom. The question posed was "Where would you like to travel around the world?". Each student or small group of students had to identify a place they would like to visit and create a tour brochure. The classroom was filled with samples of commercial brochures for Eco-Tours to many places. One of them was to Costa Rica to save baby turtles. Others focused on the cloud forests and butterflies. There were students from Costa Rica in his class, so the interest was high. They developed a bilingual brochure in English and Spanish. Macdonald's, Altman's and Holmes' interpretation of this is that it depicts an example of place-based learning. Through

the lens of place-based education (Grunewald and Smith 2007) people can become intensely engaged in a place they know intimately or are viewing in a diorama.

As anyone who has lived in or visited Germany knows, the country has unrivalled educational and cultural opportunities. And yet Germany, in common with most other countries, is a nation with considerable disparities in economic, social and cultural capital. In Chap. 4, Eva Neitscher and Hae-Yon Weon-Kettenhofen write about the work they have undertaken in the Museum Koenig in Bonn with children from a primary school in one of the underprivileged districts of the city. Seventy percent of the children at this school come from migrant families and 30% live in one-parent households. Many of these parents don't speak German and do not know about the cultural opportunities their city offers. They often have to work and therefore cannot spend a lot of time on extracurricular activities with their children. In addition, visiting places of cultural education is often too expensive.

A total of 42 children aged 7–11 visited the museum for 12 afternoons over the course of 3 months and worked on their cultural, presentation, creative, and communication skills. Among the activities they undertook, they were taken round the research areas of the museum and met the scientists who work there. The children practised working with different scientific tools such as microscopes, magnifiers, tweezers and pipettes. Afterwards, they examined different animals, some alive and moving (e.g. brine shrimps), others dead and preserved (e.g. butterflies and beetles). They were given a dung beetle (*Anoplotrupes stercorosus*) to view under a magnifier. They learned how a scientist would draw and label such a specimen and then practise what they had learned by making their own scientific illustrations.

As part of the project the children built and designed their own 60 cm × 40 cm × 40 cm dioramas. The aim was to transfer the spirit of the existing museum dioramas to their smaller space and to combine their lives with an aspect of nature. The children had to think about what was important to them in their own lives and should be preserved in a museum. Some children chose a special habitat they had seen in the museum, some chose city-scenes and some designed a fantasy world.

An art educator taught them colour-theory, techniques for colour mixing and the handling of different materials and tools. They worked with feathers, cotton wool, sponge rubber, cardboard, pieces of wood and different types of pens and paint. The three-dimensional artwork was made from dough, cardboard, polystyrene and natural materials such as pine cones, wood-pieces, conker and cork. This contributed to an enhancement of the childrens' fine motor skills and their autonomous creativity. Team spirit was another important aim of the project. As part of this task, the children learned to work collaboratively and deal with failure as a team.

Eventually the dioramas were ready: the subjects included pets they had had, penguins in their natural habitat, jungles, car races through cities, life in the Stone Age compared with today, African animals, underwater worlds, European woods and miniature museums of football or swimming. At the end of the project, the dioramas were presented in an exhibition open to museum visitors for 3 months. Nearly every child gave a talk in front of the audience at the opening of the exhibition, demonstrating how much their presentation skills had developed and how

participation in the project had increased the children's confidence in their own abilities. As Daniel, 10, said, during the opening of the exhibition: "Es entstanden wahre Welten" ("Whole new worlds arose").

There has been little work on why some visitors find dioramas more engaging than do others. What work there has been generally adopts a social constructivist perspective. A very different perspective is taken in Chap. 5 where Paul Gabriel starts by noting that only dinosaurs are more popular than dioramas to the average visitor. Gabriel then argues that we need to take more notice of the diversity that exists in the brains that people have (though some would prefer 'minds' to 'brains' and worry that even this underestimates the importance of group influences on individuals).

Gabriel focuses on three groups of people who between them account for some 15% of individuals (though the figure of 11% he cites for ADHD is for the USA and is an order of magnitude greater than in certain other Western countries, e.g. France): those with dyslexia, those with ADHD (Attention Deficit Hyperactivity Disorder) and those on the autistic spectrum (i.e. with Autistic Spectrum Disorder, ASD). As a case study, he uses a 2006 summative evaluation of the 'Fossil Mysteries' permanent exhibition at the San Diego Natural History Museum conducted by reviewers with dyslexia and/or ADHD. Their insights were complemented by persons on the autistic spectrum responding to museums and dioramas. Gabriel looked at how the reviewers responded to two dioramas within the larger exhibition: an open, noisy, highly interactive area; and a much more quiet, enclosed area.

What these reviewers said worked best were a diorama they called 'The Jungle Room' (formally known as the Eocene diorama) and one they called 'The Dead Dinosaur Room' (the Extinction diorama). In the first, visitors travel through its centre, via a wide, winding walkway, and immediately become immersed in sights and sounds of the scene. The exhibit physically dwarfs the visitor, with bird calls and animal sounds filling the air. At stations placed next to the railings along the pathway, visitors can engage with interactive components inviting them to look more closely at the environment and discover its parts, or to think more deeply about certain aspects of it (Chap. 5, Fig. 5.1). The second diorama portrays the mass extinctions marking the end of the Jurassic period but counterintuitively is situated in a silent, meditative environment. The lighting is dim, save for strong uses of blue and red evoking the post-meteor crash glow in the sky, and the focus is on a dying creature symbolising the extinction of most of animal and plant life (Chap. 5, Fig. 5.2).

Both the Jungle Room and the Dead Dinosaur Room powerfully engaged the ADHD and dyslexic reviewers' attention, mostly by creating an immediate non-verbal sense of how everything in the space fitted together. In contrast, the reviewers tended in other parts of the exhibition toward sensory disintegration, meaning that the sights and sounds and spatial layout of a space disaggregated into unrelated pieces, making them difficult to comprehend. Other features that proved successful included a clear pathway in the Jungle Room that helped maintain focus and maintain a sense of direction and purpose, but without being so constraining as to force visitors along a highly restricted pathway, and labels that didn't require too much work to decipher.

In Chap. 6, Annastella Gambini notes that visitor numbers to Italian natural history museums are low. Accordingly, interactive multimedia interfaces called digital dioramas have been developed and can be viewed at www.digitaldiorama.it. To date, four digital dioramas have been completed: Mediterranean Sea, North American River Rapids, Canadian Boreal Forest and Amazon Rainforest.

While scrolling over the main photograph, the user can zoom in to enlarge it. A zoomed image may be viewed from three different perspectives to enable more in-depth examination (which approximates to viewing the diorama close up in the museum). In addition, there is a menu offering four different levels of exploration of the diorama. At each level, a selection of hidden 'hotspots' (generally seven or eight) may be discovered. Each hotspot, placed at a strategic point within the diorama, gives access to more detailed content.

In addition, the project team has begun to develop a new section of the digital diorama site that will launch the construction of a database of existing dioramas in museums around the globe, with a view to fostering the large-scale dissemination of the world's dioramas, comparison among them, familiarisation with faraway dioramas and active on-line exchange initiatives.

Given the huge amount currently being spent on digitising the collections of many natural history museums, Gambini's seems a fitting chapter with which to finish a section on reaching different types of audiences through dioramas. There is little doubt that digital technologies have a very great deal to offer on-line visitors both in terms of learning and of engagement. What we do yet know in much detail is how this potential can be realised.

Luanne Meehitiya, Dawn Sanders and Jill Hohenstein build on earlier work by Sanders and Hohenstein in which they reflected on taxidermy in the light of children's understandings of death. In Chap. 7, they muse on the possible significance of a number of museum displays. They consider, for example, the adult human and child skeleton in the Horniman Museum, London (Chap. 7, Fig. 7.3). Such skeletons, of course, are very different from the taxidermic and life-like specimens found in natural history dioramas. They suggest that the concept of 'anti-taxidermy' may also be relevant, noting that it has been argued that the plastinated corpses of Gunther von Hagen's hugely popular *Body Worlds* exhibition are acceptable to precisely because they function as a form of anti-taxidermy, removing the skins to show only the anatomical details beneath. Certainly, it is noteworthy how skeletons are generally seen as much more acceptable than stuffed humans. Meehitiya, Sanders and Hohenstein note how it appears that skin is perceived as personal and individual, whereas internal organs and skeletal structure might be seen as universal and considered to be less emotionally confronting.

Human remains are obviously especially likely to cause an emotional response but Meehitiya, Sanders and Hohenstein point out that another display in the Horniman, one of dead dog heads (Chap. 7, Fig. 7.4) seems likely to incite an emotional reaction for two reasons: first, many of us have dogs for pets; secondly, the fact that only the heads are presented might seem grotesque, creating a sense of disgust.

Meehitiya, Sanders and Hohenstein conclude that taxidermy is liminal. It has strange effects on people, effects influenced by taxidermy itself, display techniques

and the memories, knowledge, experience and conversations that individual visitors bring to the museum. Ultimately, there would seem to be a great opportunity for families to engage with the topics of life, living and lifelessness whilst viewing taxidermy displays. These displays provide safe environments to observe real animals close up whilst giving rise to questions about how they came to be in the cabinets in which they now reside. Of course, such displays may also reinforce a fear of discussing death and dying. Researching this will prove challenging because of the intangible and often unconscious nature of reactions to concepts of life and death but there are research avenues available to study.

As Doris Ash notes, her chapter, Chap. 8, treats dioramas somewhat differently than do the other chapters in this book. While natural history museums focus largely on wildlife, they also include cultural exhibits that portray so-called 'primitive,' indigenous, or enslaved peoples and their artifacts. Native Americans and African Americans in the USA and Native Bushmen in South Africa, and others elsewhere, have pointed out that dioramas tend to be static, unchanging, putting the primitive on display and typically portraying them as 'less than' a modern culture, as people frozen in time.

Accordingly, indigenous and other peoples are asking for museum exhibits to change the typical museum presentation in order to reflect issues from their perspective instead of the colonialist, Western, European American viewpoint. Such concerns have resulted in the reconsideration, refurbishing or removal of some dioramas from exhibition galleries.

This has echoes of the 'Rhodes Must Fall' protest movement. Probably the best defence for retaining dioramas that are now seen (at best) to patronise indigenous people or (more often) present a biased view of history is that their retention might allow for critical teaching. However, in the absence of such teaching, their retention is likely simply to promulgate, rather than challenge, stereotypes.

Whether or not one retains older dioramas, more contemporary ones provide an opportunity to re-present events. Ash discusses a number of examples including the representation of slavery in dioramas; some of the earliest representations, dating from around 1820 were designed to show the 'bucolic' life of dancing slaves (sic). Newer museums, such as the Museum of the African Diaspora are designed to represent Black people in historically accurate ways that show the traumatisation and suffering experience by slaves.

Of especial interest is a series of dioramas, which featured in the 1907 Jamestown Tercentennial Exposition, held in Norfolk, Virginia. Sadly, these dioramas no longer exist but from contemporary account we know that there were fourteen of them, the first one being titled *Landing of First Twenty Slaves at Jamestown.* It showed 24 two-foot-high plaster figures to indicate the shackled, nearly nude and traumatised Africans who had landed in Jamestown in 1619. In the dioramas, their creator Meta Warrick, who was described as 'a negro aristocrat from Philadelphia', used more than 130 painted plaster figures, model landscapes and backgrounds to give viewers a chronological survey of the African American experience. Scenes ranged from a tableau of a fugitive slave to a depiction of the home life of "the modern, successfully educated, and progressive Negro" (Jackson & Webster Davis, 1908, p. 205).

As Brundage (2003) has noted: "Whereas 'Old South' dioramas and such related anthropological exhibits organized by whites *exhibited* blacks, Warrick's dioramas *represented* them" (p. 1373).

An oversimplified understanding of nature and its representations might lead one to suppose that dioramas with similar biological content would be similar in different countries. In Chap. 9, Marianne Achiam and Martha Marandino present data to show that this is not the case. The approach they take is to compare two dioramas. One, in the Zoology Museum of the University of São Paulo, Brazil, is part of an exhibition entitled 'Research in Zoology: Biodiversity under the eyes of the zoologist' and shows part of the Amazon rainforest with a number of characteristic species: a jaguar (*Panthera onca*), a harpy eagle (*Harpia harpyja*) eating a macaque monkey (*Macaca* sp.), and an iguana (*Iguana iguana*) (Chap. 9, Fig. 9.2). The other, the Zoology Museum of the University of Copenhagen, Denmark, part of an exhibition that shows the succession of ecological communities in Denmark, is part of a cluster of exhibits about contemporary Danish fauna and shows a present-day beech forest (*Fagus sylvatica*) with some of its characteristic inhabitants: a roe deer (*Capreolus capreolus*) with two fawns, a chaffinch (*Fringilla coelebs*) and a slug (*Arion ater*) (Chap. 9, Fig. 9.3). A thorough analysis was then undertaken of the two dioramas using 'think-aloud' sessions, visitor interviews, curator interviews and documentary analysis.

Among Achiam's and Marandino's findings are some that are especially pertinent to the theme of this book. They argue that the Brazilian diorama encourages a more critical pedagogy, one that is in tune with the classic work of Paulo Freire (1921–1997), a strong proponent of the view that education should provide learners with the agency and consciousness to critique and address important social issues. As one of the Brazilian exhibition designers explained:

> So, the museum has this goal, a more functionalist perspective, to give answers to these questions that are important to the people who live here. What are the situations that we have to fight in the agricultural, medical, and veterinary [areas]?

At least some of the visitors to the Brazilian diorama appreciated this critical turn. As one put it:

> Well, the jaguar is a beautiful animal, so I think it already draws attention for that reason. It is an endangered animal, so it has a certain appeal, and being endangered, we begin to think about the degradation of the environment.

In contrast, one of the Danish exhibition designers simply said:

> You have an exhibition, you want to show a story about the natural history of Denmark through time, and this being a zoological museum, you want to show the animals.

A number of the visitors to the Danish diorama took it at face value, which Achiam and Marandino see as indicating that they went along with what they held to be its positivist premise. For example, one visitor interpreted the diorama in the following way: "If I was lucky, I could see the animals in this forest here in Denmark".

In Chap. 10, Henry A. McGhie explores the proposition that natural history museums can play an important role in connecting people and nature, by supporting them to develop their own understanding of nature, to appreciate its value, and to have a positive attitude to their surroundings. At first sight, this seems a somewhat optimistic hope. Aren't such aims more likely to be realised by watching the wonderful nature documentaries that continue to pour forth or by reading great books or articles on conservation and biodiversity, or by getting people out-of-doors so that they experience nature at first hand? McGhie's contention, though, is based on the belief that museums can be a powerful medium for promoting critical thinking and reflexivity, can encourage people's self-knowledge of the world and their place in it, and can promote people's connection with nature.

As is widely known, human effects on the natural environment have been catastrophic for wildlife. In addition, a substantial body of evidence exists on the benefits of contact with nature for people's health and wellbeing. Despite this, people spend less time in nature than they used to. It is precisely because of this that museums and other 'mediated nature' experiences may become increasingly important as sites for environmental education and influencing nature connectedness. Given the far greater awareness of the need for nature conservation and of the role of humans in affecting the natural environment, it is perhaps unsurprising that an increasing number of museums are using their dioramas to communicate such messages.

McGhie concludes that museums provide unrivalled opportunities to help large numbers of people establish or deepen their connection with nature, catalysing mutually beneficial relationships and connections through effective and sensitive engagement and interpretation. Such programmes of activity, he maintains, should be seen as central to museums that seek to educate and inspire people about the natural world. In order to achieve this, museums need to critique their own practices and communications around the environment and nature, ensure that the messages they use contribute positively towards nature connectedness and support visitors to take positive actions that they wish to take.

Environmental education is widely acknowledged to be of increasing importance. In Chap. 11 Annette Scheersoi and Lara Weiser explore whether natural history dioramas can be effective tools for environmental learning. They hypothesise that museums that contain natural history dioramas can contribute to environmental education and might be even superior to other out-of-school learning environments in regard to such key aspects as interrelationships between animals, animals' needs and habitats, as these can only to a certain extent be presented in zoos or observed in nature. Natural history dioramas, in contrast, offer a scenario with a complete context in a named environment or a constructed representation with key concepts illustrated and represent interactions and relationships between animals and/or plants, illustrate habitat characteristics as well as adaptations and can include human influences.

To investigate these issues, data were collected at a Natural history walk-through diorama in the Koenig Museum (Bonn, Germany), representing the African Savannah. Some time before their study, thieves had broken into this diorama and sawn off and stolen the rhinoceros' horns. However, as the original horns had been taken away

before this incident and stored in a museum's safe to protect them from theft, the thieves just took away some copies made from plaster. The museum staff decided not to replace the horns but to present the rhinoceros without horns (Chap. 11, Fig. 11.3) to create visitor awareness and foster their engagement with conservation concepts. A text label was provided to explain what was going on.

However, only few visitors spontaneously commented on conservation biology issues; for example, one woman said:

> Look, even this rhino does not have any horns anymore. It's because animal welfare activists took many horns off to prevent rhino poaching.

Many visitors seem not to notice the rhinoceros with its horns cut off, perhaps because they do not expect such incidents:

> I: "Did you reflect on themes such as human influence on nature or wildlife conservation when you were visiting this diorama?"
> V1: "That does not really come up here, because all kind of species are present and human beings cannot be noticed, everything looks really idyllic. If there had been a street or a hut or something man-made, but everything is just like you imagine."
> V2: "If they had thrown some Coke cans in here the theme would have been more present. Or birds exposed to oil or something like that. But here everything is very untouched, natural."
> V1: "That's what one wants to see I guess."
> V2: "Yes, such an idyll, maybe even cliché."
> V1: "Indeed, pristine, in a natural state as it should be."

Scheersoi and Weiser concluded that visits to museums with specific habitat dioramas can increase visitors' ecological knowledge and awareness. In addition to explaining scientific facts and environmental problems, dioramas have the potential to connect learners to the natural environment and to evoke emotional reactions. However, specific cues need to be provided in the diorama if visitors are to engage with conservation concepts. It also became clear that such cues have to be obvious, clear and easy to understand, to avoid any misinterpretations.

In Chap. 12 Keith Dunmall begins with the uncomfortable fact that many of the visitor comments in the Powell-Cotton visitor book are along the lines of 'no wonder they have gone extinct, he shot them all'. In response to this oft-repeated interpretation, it was decided that the core of a new exhibition would be on extinctions. The IUCN Red List has a hierarchy from those species of *Least Concern* to those that have become *Extinct.* The initial suggestion for the exhibition was the complete covering or removal of the target animals and in the case of removal, replacing them with cut out silhouettes to identify where they had been. After discussion, it was agreed instead to put ribbons around the muzzles of the animals, colour-coded as follows to indicate the status of the animal on the IUCN Red List:

Black	Extinct
Purple	Extinct in the wild
Red	Critically endangered
Orange	Endangered
Yellow	Vulnerable

It was also decided that alongside each of the animal names a symbol would be included to represent which of the following eight key causes were a factor in the animal's status:

Climate Change
Competition with Livestock
Deforestation
Disease
Habitat Loss
Human Encroachment
Hunting
Poaching

It was found that students from the 14 schools that visited the exhibition talked much more about conservation issues that other visitors did before and after the exhibition.

In Chap. 13, Martha Marandino, Juliana Bueno, Marianne Achiam and Carolina Laurini examine data collected at the same two museums as those studied by Marianne Achiam and Martha Marandino in Chap. 9. They were particularly interested in the potential of the dioramas to teach ideas about biodiversity. However, as others have found, it turned out that visitors very much focused at the species level, both in Brazil and in Denmark. Visitors also made comments at the ecosystem level, though not as often as at the species level. However, visitors did not make any comments relations to variation at the levels of individuals, populations or taxa. Comments about conservation were sometimes made but about biogeography and evolution only rarely. As the authors note, the results reveal both the potential and the limitations of dioramas for teaching about biodiversity in museums.

As is well known, most natural history museum dioramas throughout Europe and North America put their emphasis on animals, with artistically painted natural landscapes in the background and life-sized plants in the foreground. A fine example of plant dioramas is provided by the seven life-sized window dioramas depicting different biomes of the United States on display at Botany Hall of the Carnegie Museum of Natural History in Pittsburgh, Pennsylvania. However, the production of life-size plant dioramas is extremely challenging and time consuming.

14.3 Conclusions

Dioramas inevitably reflect the values of those individuals who commission and create them and the societies in which they live and work. The sociocultural perspective to our understanding of dioramas in this book therefore adds to the educational focus in the companion book. Looking to the future, dioramas have the potential to make visits to natural history museums both more engaging and more challenging. They can engage with visitors as a play can engage with viewers – there is in both cases a considerable degree of staging. They can challenge because,

beautiful as organisms are, many natural museums will want their exhibits to be more than just aesthetically pleasing. Good exhibits can cause viewers to think and to have their assumptions questioned; they can give rise to new lines of deliberation so that visitors leave with fresh perspectives, perspectives that sometimes may be personally troubling.

Together, these two books provide a wide range of examples of how dioramas may be interpreted and used. As is generally acknowledged, dioramas are making something of a comeback, and this is to be welcomed. Furthermore, the fact that they so clearly present a staging of reality can prove helpful to our understanding of other natural history displays, and people's reactions to them, where this is just as true – think of displays about evolution (e.g. Scott 2007) – but may be less evident.

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