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Dusty Relics or Essential Tools for Communicating Biology?
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Introduction

Natural history dioramas typically combine preserved organisms and painted or modelled landscapes. They were historically designed to evoke feelings and to promote an ethic for the preservation of species and their habitats (Insley 2007). Collections of exotic animals were established for the satisfaction of a curious public and the edification of scientists. Karen Wonders conducted the most comprehensive study of dioramas for her PhD study, which was published as a book. Her work is summarised (Wonders 1989).

Natural History Dioramas had their hey-day in the late eighteenth and early nineteenth and have nowadays often been derided as old fashioned and as low technical exhibits unworthy in a computer focused, push button age. Interactive museum exhibits, designed by a new generation of designers and marketing professionals, have captivated museum directors. Yet, after a several decades of 'push button' and 'hands on' exhibits, computers are now commonplace. Visitors are overheard urging children to look at "the real things" of whatever subjects, cultural or biological, because they can "...do computer things at home".

The natural history diorama as a unique genre of reality exhibit is emerging as a key tool in biological and conservation education. The Carl Ackley dioramas of the American Museum of Natural History in New York for example are still a tremendous visitor attraction. A number of museums in the USA have recently extended their dioramas (e.g. Denver, University of Nebraska, Lincoln, and Boston), and new dioramas have been constructed worldwide (e.g. in the Natural History Museum in Malta, the Museum of Scotland in Edinburgh, Museum of Natural History [Ottoneum] in Kassel, Germany, and different museums in China). Dioramas can provide the whole picture of a given habitat and biome. They reflect or construct reality.

Dioramas as useful tools to communicate biological science?

Our particular interest is in dioramas not only the story they tell but also the story and inquiry they can stimulate. Dioramas have a tremendous educational potential and can be used to communicate science to a wide audience. Nevertheless, the educational literature on dioramas is still small, and dioramas do not feature in major texts on museum learning. Existing literature considers that dioramas draw visitors and have a high intrinsic value (e.g. Breslof 2001). By their stillness, they offer visitors the opportunity to 'stand and stare' (Tomkins and Tunnicliffe 2001) and stimulate narratives (Reiss and Tunnicliffe 2007). All kinds of dioramas provide emotional access to topics (Insley 2007), and, as depictions of reality, contrived and authentic replication (Tunnicliffe 2005), they are valuable records of the animals (and plants) on the site on which the diorama is based (Quinn 2006).

Natural history dioramas are increasingly appreciated as valuable genre of museum exhibit and their key role is more and more recognised by the museum professionals with a developing appreciation of the importance of such exhibits, albeit some from over a century old, in contributing to visitor's understandings of their work and that of conservation and taxonomic biology. Using natural history dioramas to develop and communicate aspects of biological education and inquiry science is an innovative concept, which has arisen from research into the content of spontaneous conversations of visitors at natural history dioramas (e.g. Tunnicliffe 2009, Scheersoi 2009). Researching such communications, the visitor's behaviour and interpretations are developing into an important aspect of the biological education work of natural history museums and is now being developed by more researchers. Examples of research findings on the educational value of Natural History dioramas will be given below.

Background: Museum learning

When people look at exhibits, be they in a science museum, botanic garden or zoo or specimens on a field trip, they construct meaning from what they see, what so ever it is, animal, vegetable or mineral or constructed artefact. As a museum audience, visitors interpret exhibitions using a variety of personal and cultural influences view (Scott 2005). Animals as exhibits, as well as those of the farm or living the wild, have an apparent fascination for human beings who watch and interpret animals for themselves (Kellert and Westervelt 1982; Eagles and Muffitt 1990). However, attitudes and emotions are not intransigent. Bitgood (1992) points out that exhibits reshape visitor attitudes through the thinking that they stimulate in the visitor, and both Alt (1980) and Stevenson (1991) show that the viewing of exhibits by visitors and their interactions with them are coloured by feelings of enjoyment or emotional involvement, as well as an inherent predisposition to them. Visitors have the potential to react with exhibits in a number of ways through which they become engaged in a mental process. Visitors can 'explore' the exhibit, using both their own personal context and the information provided by the institution. However, the type of the exhibit guides a visitor in the form of mental interaction available with it and such

interactions range from observation and discussion to visitors constructing new meaning and acquiring further understanding which they are able to relay to their group and in turn teach other individuals.

A successful exhibit, from the museum's perspective, is one which entertains and educates (Screven 1986), yet transmits a message that is both received and comprehended by the visitors. If the visitors talk about the exhibits, the museum may judge them to be successful in terms of purveying their message but what level of education is this? Is the message really received? Visitors do not always abstract the message from an exhibit which the designers envisaged because of a number of factors. Firstly the perceptual processes of visitors act as filters which act to reduce the fidelity of the exhibit message to the visitor. These perceptual filters do this by forming either a complete barrier which effectively prevents the message 'getting through' or distorts its meaning (McManus 1987). Secondly, people tend to look at and note that with which they are familiar and often ignore phenomena which do not connect to what they hold in their minds (e.g. Scheersoi 2009).

The skill of the museum as a communicating institution, through its interpretative techniques, is to link what the visitor *already knows* and feels with the *information which the institution possesses* about its exhibits. In this way, a meaningful 'museum experience' is created for the visitor in terms both of personal context, enjoyment and the acquisition of information. The museum experience is discussed further by Falk and Dierking (1992) and Hein (1998) amongst other authors.

Whilst visitors may acquire new knowledge during their visit, they will build on what they already know. Museum educators should remember however, that the word 'learning' is used synonymously with associated terms such as 'education' by many institutions (Falk and Dierking 1992) and in fact people, in our educational experience, find things out during museum visits but real learning occurs much more rarely, the fact being forgotten shortly after the visit unless further consolidation and discussion occurs. It is important to realise the distinction between a transfer of facts and learning. The term 'education' has been used by museums to refer to the provision of information, rather as a recipe provides information to cooks but does not seek to educate them, merely inform. However, if education, meaning communicating, discovery and knowledge acquisition, or learning, in terms of constructing understanding, is to occur at exhibits, learners must be able to place the exhibit in a conceptual framework which is meaningful to themselves and it is important to understand ways in which existing concepts may be altered through interaction with an exhibit.

It is important for educators and curators to understand both, that which catches the attention of visitors, and how they make sense of what they see, so that relevant strategies can be provided to assist them in learning more about the topic displayed.

Educational research at Natural History dioramas

The dioramas were originally designed to carry both scientific and contextual messages but what are the messages received by the wide museum audience e.g. school children, who are

conscript visitors (Tunnicliffe 1998) brought by schools for curricular purposes, children brought with other adults for their own objectives, social leisure or educational, adults who choose to attend, and older visitors, what sense do they make of these messages?

There are various ways of finding out the impact of the exhibits on the visitor and their interpretation of them. One can listen, record and analyse spontaneous conversations, one can question an interview, visitors can be questioned and interviewed after seeing the dioramas, and drawings of the dioramas can be used as will be shown below.

What the diorama means to the visitors can be elicited at least in part by asking them to tell the story of the dioramas, what is it all about. The following responses are of such an interview:

An 8-year-old boy was asked to tell the story of the diorama he was at (three Kodiak Bears). He moved the conversation to another nearby diorama and then another and then closed the dialogue by saying he was going to look at his favourite dioramas:

Boy: *I see a bear. (Identity)*

Researcher (R): Anything else?

Boy: *No.*

R : What time of year do you think it is?

Boy: *Well, fall because there are no leaves. (identity with justification). Let me show you the one that I like. (activity justification)*

They moved to the Dally Sheep.

R : Why do you like this one?

Boy: *I like the goats (nearest fit identity) because they live on these rocks and have big horns. (justification form of habitat behaviour and diagnostic feature). I have a second favourite; let me show you which one it is.*

They moved to the Bobcat

R : Why do you like this one?

Boy: I like him because he is eating the bird and walking in snow. (behaviour observations and aesthetic justification for his choice)

The child shows knowledge by identifying the main animal and other artefacts and bio facts. He then draws on the evidence from what he sees to postulate about the possible temperature, making an evidence-based statement about the weather and explaining the behaviours shown. He shows his preference for some dioramas and the fact that he had been visiting the museum before.

Before we continue to illustrate the visitors' way of interpreting the scenes presented in Natural History dioramas, some specific characteristics of this kind of museum exhibit will be depicted.

Natural history dioramas: seminal characteristics

Natural history dioramas have several seminal characteristics of design: Firstly, the correct species of animals and plants are shown together, this is in geographical terms as well as natural relationships, particularly of feeding. Dioramas thereby overcome the barrier of exhibiting plant and animals, both predator and prey, in realistic situations together. Secondly, animals are usually depicted doing something interesting, which is not, necessarily the case when making first hand in situ wild life observations. Thirdly, dioramas of museum animals have a distinctive calm and stillness about them. Fourthly, even though they may depict acts of predation, natural history dioramas often have a 'Garden of Eden' feel to them. There is no disease or malnutrition – animals are inevitably shown in the prime of health and physical fitness. This 'ideal world' phenomenon has been noted elsewhere in children's drawings (Reiss et al. 2007) and this reflects an idealistic view of reality a view of 'what should be' rather than the 'what is'. Fifthly, dioramas combine different disciplines within a single exhibit: they display biological, geological, meteorological, ecology and cultural concepts, whilst also providing an aesthetic experience. They provide a context for the animal and communicate messages from a variety of areas. Indeed the backdrops have been utilized go help pupils understand the weather, for instance in a NOAA project at the American Museum of Natural History (Holmes 2009).
By these specific characteristics, Natural History dioramas are, at their best, super exhibits and one of the most powerful techniques for emotional access and potentially effective biology learning.

Visitor's conversations at dioramas

The conversations generated and the stories told at dioramas can be used as source of our understanding of the responses of visitors to these exhibits and the messages as information bytes which are embedded in the exhibits.
There are three main ways of analysing pupil conversations, which apply to any visitors at exhibits, have been identified (Tunnicliffe and Reiss 1999). Using a systemic network approach the content of a conversation in terms of the context in which the exhibit is shown and a description of and identification of the object, its behaviour and the feelings elicited by the object in visitors as well as their statements of knowledge can be identified effectively changing qualitative conversations to quantifiable data (Tunnicliffe 1995). Secondly, Bloom (1992) described what he termed contexts of meaning. In conversations the talker makes a description of expression based on personal experience, which gives, rise to episodic knowledge statements or expressions of emotion, the use of metaphors and similes or displaying interpretive frameworks such as "That worm's a boy because it's fatter." Lastly, Cosgrove and Schaverien (1996) identified the processes of science occurring in the conversations of children when engaged in science work. They subdivided the types of conversations into descriptive, factual and explanative conversations to peers or teacher about an investigation. The type of conversations moved through asking why and how questions, often associated with episodic memories, to conversations, which raised and tested

hypothesises to lastly philosophical conversations. When visitors look at exhibits, especially dioramas, these varied types of conversations are present.
Research (Scheersoi and Tunnicliffe 2009) observed behaviour of visitors, and their spontaneous conversations were recorded and analyzed. The data indicate, that visitors act just like at other museum exhibits (Tunnicliffe et al. 1996). Initially they identify the specimen and name it and often comment on a salient feature or structure. At dioramas, they also describe behaviours and make affective comments. If their interest is caught, they start interpreting the scenes presented, mostly in anthropomorphic terms, seeking to relate the subject to what they know and understand. Visitors rarely read the information provided by the museum (texts) and interpret at the level of their biological knowledge, which is generally basic. They may raise questions about the subject, ask why, how and what and construct hypotheses. In most cases, this typical biological dioramas interaction sequence occurs: identify – interest – interpret - investigate (fig.1). However, the order of these four typical activities may vary.

Figure 1: The "four I's-sequence" at Natural History dioramas

Identify
Visitors recognise salient features of animals or plants presented in dioramas and match them to an existing mental model thus recognising a type of animal or plant. They use the name of "nearest fit" when they cannot recall or find the correct name for an organism, a way of maximising similarity between category members (Markman 1989). They are creating an artificial category depending on their previous knowledge but the category of nearest fit provides a starting point to develop further narrative or interpretation. For example, visitors recognise black on white stripes as belonging to species of zebra, animals with hair, horn and hooves are goats or antelope, birds with pink feathers and long legs are species of flamingo. The context (habitat, different species of animals and plants, interrelationships, cultural artefacts ...) helps them to create meaning from what they see. The following spontaneous conversation at a beaver diorama illustrates this phenomenon (data generated at the Academy of Natural Science Philadelphia, USA):

Girl: Look chipmunk, lake, and look at birds in the tree.
Mom: What else? I think the beaver ate the tree. Where do they take the wood?
Girl (pointed): It's called a dam. Chipmunk.
Mom: We get chipmunks in our yard sometimes, haven't you seen them?

This conversation also shows that even though children may have a wilderness deficit (Louv 2005) they are in touch with their everyday nature (Tunnicliffe, in press) but not in an overall comprehensive way.

Interest

The role of interest in holding attention and encouraging learning has been mentioned from different authors (e.g. summarized by Krapp 1999). An interest-based action has the quality of intrinsic motivation and provides a positive emotional experience. Visitors have a limited knowledge of the complex fields of biology and educators need to introduce them step by step to the issues. Such efforts are more effective if the visitors' interests are engaged and developed. Studies in different museums have been conducted to find out which specific features in natural history dioramas support the development of interest by attracting visitors and encouraging focused observations and continued curiosity (e.g. Scheersoi 2009). Analysis of the data indicates that interest is engendered by recognising either the familiar, seeing young or big or dangerous animals, or by the unexpected (e.g., human traces in the wildlife scenes, such as a beer bottle in an elk diorama at Senckenberg Museum in Frankfurt). Visitors spontaneously name certain specimens and scenes, comment about that to which they relate personally or start questioning phenomena that do not fit with their existing ideas. They show emotional reactions concerning the animals presented (=> affective), the diorama design and arrangement (=> aesthetical) and historical aspects or human traces presented in the diorama (=> cultural, experiential).

In conversations of primary children at the late dioramas in the Natural History Museum London, affective comments were heard more often in conversations than they were heard in the zoo (Tunnicliffe 1995). An 8-year-old girl said at the Water hole diorama, "It's beautiful." In contrast, a 5 year-old girl interpreted the dioramas by announcing "These things are all dead, the giraffe and its baby", and promptly began to cry. This is a very unusual comment but illustrates the spectrum of emotions generated at dioramas. Hence, looking at dioramas elicits not only intellectual but also to emotional responses.

Diorama drawings made by children record selective features, those which they find most relevant. These are, in general, connected with their personal experiences, including every day observations of animals around (pets, farm animals, local wild animals), media representations and narratives. These features vary strongly between the individual children.

We conclude that dioramas stimulate interest if they evoke emotional responses and provide different anchor points which enable visitors with varying individual background to relate previous experiences to the scenes or artefacts presented. Interactions with this sort of dioramas result in visitors' feelings of enjoyment, involvement, and stimulation which are the most typical emotional aspects of an interest-based activity.

Interpret

Visitors come to the diorama on their visits with some knowledge relevant to the content in most cases. In their view their knowledge is pertinent to the exhibit and they often use this and only this on their interpretation of what they see. What the visitor hold in their mind is their mental model. What they saw or draw about the exhibit is their expressed model (Buckley et al. 1997), which calls on information held within their mental model.

The knowledge and understanding which visitors bring to the exhibits influences both what they observe and how they interpret it. Such information obtained enables museums to understand their visitors are becoming more and more a feature of museum work.
Studies have been conducted to assess the prior understanding of children of local endemic wildlife and then eliciting any increase in understanding and knowledge through analysis of drawings after a visit to the natural history dioramas (Mifsud 2009). In the following conversation at a diorama in the USA, the two seven year old boys are interpreting that which they see, naming organisms to the nearest fit, a name they know of a specimen that has the diagnostic features of the type with which they are familiar. They interpret the animals' behaviour referring to their previous knowledge.

Boy 1: Looks like a party! Those boars [peccaries, a nearest fit naming] could be waiting for those animals [Desert Big Horn sheep] to pass by and jump out at them.
Boy 2: Think they are mountain goats [identity, nearest fit] in sort of desert, they are just trying to walk by.

This next conversation was held amongst a school group of nine year olds at a Puma diorama set in a local park. There was a puma on a rocky ledge below which were some deer. It is also an example of parallel conversations, the girl is looking at the features of the diorama whilst the boys focus on the action in the science.

Boy 1: No it's bigger, that's a puma.
Girl: It looks like a puma trying to catch sheep. [behaviour, hypothesis from noting position of specimens and artefacts]
Boy 2: When they get in front of the rock [the deer] he'll jump down and grab them [behaviour, hypothesis]. He's pretty much concealed from them.
Boy 1: That's what bobcats do, they jump down. [explanation of behaviour from recall]
Girl: Habitat, looks like a forest.

Educators in museums have the important role of assisting visitors in interpreting the exhibits. Before strategies can be designed and implemented it is crucial to understand both what the visitors notice and what sense they make for themselves of the exhibits in question.
We mentioned before that visitors interpret at the level of their biological knowledge, which is generally basic. To overcome the existing knowledge and understanding deficit (see figure 2), visitors have to be assisted. Illustrating the salient diagnostic feature of the phyla, classes and species as represented by the specimens exhibited would help establish the taxonomic features, which could be employed by educational, strategies to establish fundamental principles of classification. For instant, whether birds have feather and mammals have some kind of hair covering, fur, and spines or hair as the case may be. Further information could explain the behaviours portrayed which again would confirm or extend the ideas which the

children raise from their observations. Furthermore, interpretation of some form could establish the habitat features and the interrelations of the specimens to the habitat features portrayed.

Figure 2: Biology education triangle of concepts illustrated in dioramas

Assisting the visitors in interpreting the (biological) information presented should not be a didactic experience though, a transmission of facts by 'educators', in the English sense, including the worksheet, teacher, and chaperone accompanying groups. A museum visit is a social nurturing experience and should be focused on talk, for talking is the initial stage in literacy. A dialogic talking style is that usually employed with very young children, starting with labeling (naming). Research conducted by the authors reveals that a great deal of museum talk is of this nature. Such talk is developed into dialogic talking by the adult or peer once a 'label' has been established, asking for justification of ascribing that name to that object or phenomenon. The facilitators act as the 'significant other' in Vygotskian terms.
The three following conversations from family groups and a school group with their teacher illustrate typical styles of conversation at dioramas (data generated at the Academy of Natural Science in the USA):

At the Desert diorama
Girl: Is that a porcupine or hedgehog over there?
Mom: What kind of habitat?
Girl: Desert.
Mom: Look at the curly horns almost on to their back.
Girl: Yes.
Mom: What are these?
Girl: Buffalo we saw at farm, two of them. I think that's two sisters and that's Mom and baby.
Mom: Do they all have horns? I wonder what they feel like?
Girl: Woolly.
Mom: Do you remember touching an alpaca?

At the Polar Bear
Mom: What do you like?
Girl: Polar Bear.
Mom: What colour is his coat?
Girl: White.

At the diorama of a polar bear on an ice floe with a seal kill
Boy 1: A Polar Bear. [identity, previous knowledge]

Boy 2: The seal is dead. [interpretation, previous knowledge]
Boy 1: The polar bear is killing it. [behaviour description] They are all stuffed. [information from knowledge] That's our favourite animal at the zoo. [personal affective comment, interest]
Teacher: That's a Northern Fur Seal [text echoing - observed reading from label]. That's what happens in nature, they have to eat. [teaching point re predator prey]
Boy 1: That's Walrus blood - that's seal's blood. [hypothesis, explanation]
Boy 2: Kevin, he has got big teeth. [diagnostic observation about polar bear]

Programs have been conducted and evaluated in the Denver Museum of natural Sciences (DMNS) using enactors to talk to visitors in front of dioramas and to discuss the phenomena presented (Tinworth 2009). These programs were very successful and helped to enrich the visitors' understanding of the themes, concepts, and content of the dioramas and of the Museum.
The natural history museum is often deemed an informal learning environment. In the case of school children and other learners it is effectively a learning place outside the base classroom. Such extension learning sites have an important role to play in engaging the learner's intellect in finding their own best pathway to learning. In using natural history dioramas the educator can encourage the learners to take more than a quick look at exhibits but to look with meaning and construct deeper understanding linking with their existing knowledge.

Investigate
Governments worldwide require, through their national curricula or standards that pupils learn not only facts but also skills and processes, with emphasis on science method, which is often referred to as science inquiry, the scientific method. The fundamental starting point is observation, pupils have it be guided into looking with meaning and rather than just seeing or imagining what they see based on mental models already held (Tunnicliffe and Litson 2002). Careful observation, identifying common features and seeing patterns, is the mainstay of basic biological studies at both the macro and micro level. Dioramas have been however neglected by educationalists but, through looking with meaning at natural history dioramas, learners of all ages can learn to observe carefully, notice and seek further details of patterns, detect sequences of events, notice similarities and differences, interpret behaviour shown by the position of the animals, plants and artefacts and make connections with the understanding with which they, the observer, comes to view the dioramas. As mentioned above, dioramas offer by their stillness opportunities to "stand and stare" – to observe carefully. Dioramas are indeed 'snapshots', thus they are a moment frozen in action, so visitors can view and ponder and look again, unlike live animal exhibits in zoos, which perform a different function for their visitors. Moreover, in contrast with the single taxidermically prepared animal, the specimens in natural history dioramas are shown in their natural context and many messages

are there for visitors to interpret. If visitors look with meaning they may develop acute and accurate observational skills.

Dioramas stimulate narratives, and studies have shown that childrens' narratives and explanations often develop into inquiry science: They observe, ask questions, formulate hypothesis which they try to corroborate by comparing scenes presented in the diorama with their own experiences and previous knowledge (Tunnicliffe 2007). Other research (e.g. Gatt et al. 2007; Tunnicliffe and Reiss 1999) finds that knowledge is acquired also from amongst other things, television, children's books).

The following conversation was held between three nine year old school children looking at a diorama of Caribou at the Academy of Natural Science Philadelphia, USA). It shows another example of parallel conversations, one between the two boys as they note diagnostic features and then postulate on the gender of the specimens. And a separate line of thought spoken by the girl.

Boy 1: No horns, biggest horns and big horns.
Girl: This glass is really clear.
Boy 2: Looks like a female (identify, hypothesis) – really he's the leader (big horns) you tell that's the female by the expression and no horns (identity, justification).

Inquiry is both the art and science of asking questions about a phenomenon, in this case natural history dioramas portraying the natural world, and finding answers to those questions. It involves careful observations and measurements, hypothesizing, with reasons, interpreting and theorizing. Indeed, inquiry-based learning is a way of acquiring further knowledge and understanding through the very process of questioning. Learners may raise the questions themselves spontaneously from their own first hand observations connected with their mental model of the subject of the dioramas. Alternatively, the question may be put to them by an educator to scaffold their thinking and develop concepts require by curricula.

Inquiry based science can be encouraged and developed in natural history museums particularly at dioramas with an emphasis on observations and constructing meaning from them linked with the mental models of the phenomena observed which the planners already have. Prominent signage, or other forms of interpretation, such as explainers, or well-briefed teachers and chaperones, at various locations, would provide information for children or general visitors to establish the enemas of the specimens and the aspects of the location. Such signage would verify the observations and hypotheses, which the visitors engender through their observations and could lead to more careful observations.

Conclusion and implications for biology educators

Museum visitors, be they school attendees or lifelong learners, vary in their learning styles, academic and artistic strengths. Thus scientific instruction needs to be flexible enough to

accommodate the cognitive differences amongst the range of visitors. Natural history dioramas attract visitors and can provide ideal initial conditions for teaching biological science in an out-of-school setting for all categories of learners – dioramas can be accessed and interpreted in different ways according to the highly variable scientific knowledge, interests and experiences of the visitors.

These exhibits, depictions of reality, posses a high intrinsic value alone by their being there to be looked at, without any other interpretation other than the understanding visitors bring and observations they make. However, museum educators could respond to the highly variable scientific knowledge of the visitors which is revealed by analysis of responses at given dioramas through making use of the various responses. Various strategies could be provided focusing on the varied content of the dioramas making them accessible for direct interpretation by the visitor. The focus of intervention initiatives should be on accurate 'minds-on' observation rather than physical 'hands-on' manipulation of objects and invite questions from the observer. A useful perspective can be to see dioramas as 'story tellers'. Visitors respond well to stories, and bring their own experiences, hopes and fears to them, but to maximise the educational impact of dioramas, the stories needs to be read with some care (Reiss and Tunnicliffe 2007). Visitors construct meaningful narratives at dioramas, which can provide a starting point in discussion and development of the science process. However, some of the visitors do begin to raise questions, construct hypotheses and explain in their terms. When such questions and hypotheses are heard this is the ideal time for an intervention, which could scaffold the visitor's thinking and help construct further concepts. Schools could use the observations and discussion of their pupils as a starting point for developing inquiry science.

Museum learning should be collaborative and should be a social experience and be multisensory. There is a spectrum of genres of exhibits. A live animal exhibit is totally different from a cultural artifact. We should not use 'one size fits all' in our approach to museum discovery encounters but assess the role of education and educators and change from using 'teaching' to finding out with 'significant other'. At any exhibit there is an experiential zone in which the viewer and the exhibit occupy a 'space' and in this something or someone, label or person or interpretation, can act as a 'significant other' in this zone of potential development. Through dialogic talk, to the self or to a person, a visitor may link existing concepts to something they know and increase their cognitive development in the area. Analysis of their personal narrative at exhibits can reveal such accommodation and development. A cue sheet might aid in part dialogue of the self with the exhibit. Challenge the almost mandatory use of worksheets and tick boxes as the perceived mainstay of museum education. Such provide documentary evidence, usually of collaboration amongst peers and adults, but the value to pupils of this written task oriented visit, is questionable. Reading and writing is a Western curriculum fixation. Oracy, talking and listening, are two of the four equally important strands of literacy, and dioramas provide a stimulus for these aspects of literacy to develop extremely effectively.

Discovery Learning begins with talking about what is observed and the sense the lookers makes of the images they view, be they two or three dimensional, reduced, enlarged or life size. Observations may lead the observers to ask interesting questions. Posing such questions may lead the person questioned to consider important science issues that are meaningful to them and about which they willing to tussle mentally to find the answer. Talking is the precursor of reading and writing. Why do some museum educators strive arrogantly to make their visitors learn? Let us work to encouraging observations and narratives through the stimulating environments - of museums, finding out, so visitors talk, and, if museum staff, teachers, chaperones or parents, feel the need to cue the visitors, do it in dialogic manner. Let the visitors draw, record electronically if they are comfortable with that mille, that which interest them. Write if they want to a key word as an aid memoire for further research to extend the information, but above all look, think and say!

The natural history diorama is recognised by many museum educators and educational researchers as possessing a powerful potential for science education in terms of processes and skills as well as knowledge and furthermore offer a unique interest to humans who have the need to interact with the rest of the living world. They are an exceptionally effective medium for learners to acquire elements of biodiversity information such as habitats of particular animals and interrelationships of organisms. Dioramas of the natural world are a vital part of portraying the natural world to people, adults and children. They should be cherished and used in effective educational strategies, which assist in an individual's science education.

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Biographies

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Dr Annette Scheersoi is a researcher and lecturer at Frankfurt University. Her research on biology learning focuses on interest development in out-of-school learning environments. Her doctorate was on museum exhibition concepts and the use of different media for communicating biological knowledge.