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The Educational Value Of Natural History Collections In Learning About Biodiversity

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Visitors to natural history museums see museum animals, models or those which have been taxidermically preserved. Do people have to see the 'real thing' in order to learn about animals? If the answer is 'Yes', what do the people who say that they do so mean by 'real'? In a zoo a viewer of animal specimens does indeed see a "real animal", albeit one that usually exists in an artificial setting, without any prey, predators or other natural threats. Hence the zoo animal is yet another type of image, live, but represented in a human constructed frame and constrained by this very design. The design of an exhibit sets a context in which the animal is seen and this artificially created surround helps form the image of the animal in the mind of the onlooker.

Studying images of animals in a natural history museum, of which the majority are mammals, is more effective in terms of what visitors notice and comment upon than looking at animals in zoos. I have focused on

primary age children and the accompanying adults. My studies have shown there is a similarity in content of the conversations generated at animal exhibits amongst both school and family groups, and for both groups, has a higher content of knowledge statements in museums than in zoos.

The Collins Dictionary as defines learning:

1. Knowledge gained by study, instruction or scholarship.
2. The act of gaining knowledge. It is synonymous with many words: acquirements; attainment; culture; education; erudition; knowledge; letters; literature; lore; research' scholarship; schooling; study; tuition; wisdom.

One of the huge problems in the museum world and that of visitors studies is that learning is taken to mean many of these definitions, hence we often talk at cross purposes. I take learning to mean the second definition, 'The act of gaining knowledge'. I take the 'gaining' to mean the learner actively constructing the knowledge and understanding. I consider that the term 'finding out' is far preferable to use when asking visitors what they 'have learnt' form an exhibit.

One way of investigating what children learn about animals is to examine the mental models they reveal through their talk when they come face to face with animal representations. Moreover, a museum's story is told mainly through its exhibits. However, this story may not be 'read' by visitors, who come with their own knowledge and understanding, and read a different one which makes sense to them and builds on what they already know. A visit to the natural history museum is part of many pupils' educational programme. One way of investigating what children learn about animals is to examine the mental models they reveal through their talk when they come face to face with animal representations.

Information is one of the necessary tools for education but the manner in which the new learning information is introduced, how the learner is aided in constructing meaning from

the new information, and how the learner conducts a dialogue with the self are at the core of educational process. Conversations are key to education. The skilled teacher knows when and how to provide the key verbal links that lead a learner to the next stage in their understanding of concepts and skills. Such sensitivity and skills should be in the possession of museums and zoos.

There are a number of factors which are useful to consider before trying to assess learning or attention to museum exhibits. There exist a series of conditions or needs that must be identified before we consider the role the personnel of the group contribute. Firstly rationale for the visit. If the visit is part of the formal learning agenda for children it would be expect be that a high degree of 'teaching' by the teacher (or parent helper) and effective teaching by the exhibits, if they are specifically designed to 'teach' at curriculum level rather than at an everyday one, would be identified in the conversations. However, the exhibits are regarded by the visitors to provide a background for their personal social interactions and some incidental fact acquisition occurs. Secondly, there is a familiarity issue or an encounter level. How familiar are children with the topic? This links with rationale. If this is the first encounter with such specimens or indeed any animal specimens, children's observations may be at a familiarisation level. Does the amount of information heard depend on the ' encounter level' at which visitor approaches the exhibit? Does conversational content and function reflect encounter level? Thirdly, there is the issue of identifying science education in operation. Is a science conversation one that uses previous knowledge, one with 'science' content e.g. 'proper species names of animals (in English), order and phyla etc. appropriately used and one which relates form to function in non-anthropomorphic terms? Fourthly, can we identify teaching and learning dialogues? What is a teaching conversation? Are the content or form and the function, that is why speaker is using the words, apparent?

However, physical interaction is not necessarily mental interaction. What type of physical interaction is available at your

establishment? What do the visitors do? The interaction of the mind, 'Minds-on', is often limited and physical interaction where activity such as pushing a button is provided appear to mask any thinking interaction other than at a low level of 'This what I do with this button'.

However, physical interaction is not necessarily mental interaction. What sort of physical interaction is available at your establishment? What do the visitors do?

The interaction of the mind- Minds-on- is often limited and physical interaction where activity such as pushing a button is provided appear to mask any thinking interaction other than at a low level of 'This what I do with this

button'. A summary of these interactions is shown in figure 1.

Museums and zoos have exhibits which have a message with which these institutions are familiar. However, *their* knowing what *they* expect *their* visitors to understand from the exhibits is only part of the picture. It is particularly important for science educators and museum and zoo personnel, educators, valuers, exhibit designers, graphic writers, to know:

- what visitors point out and tell each other - for they talk about that which interests them (Falk and Dierking, 1992) and in the case of schools - that aspect of the curriculum about which the visits is

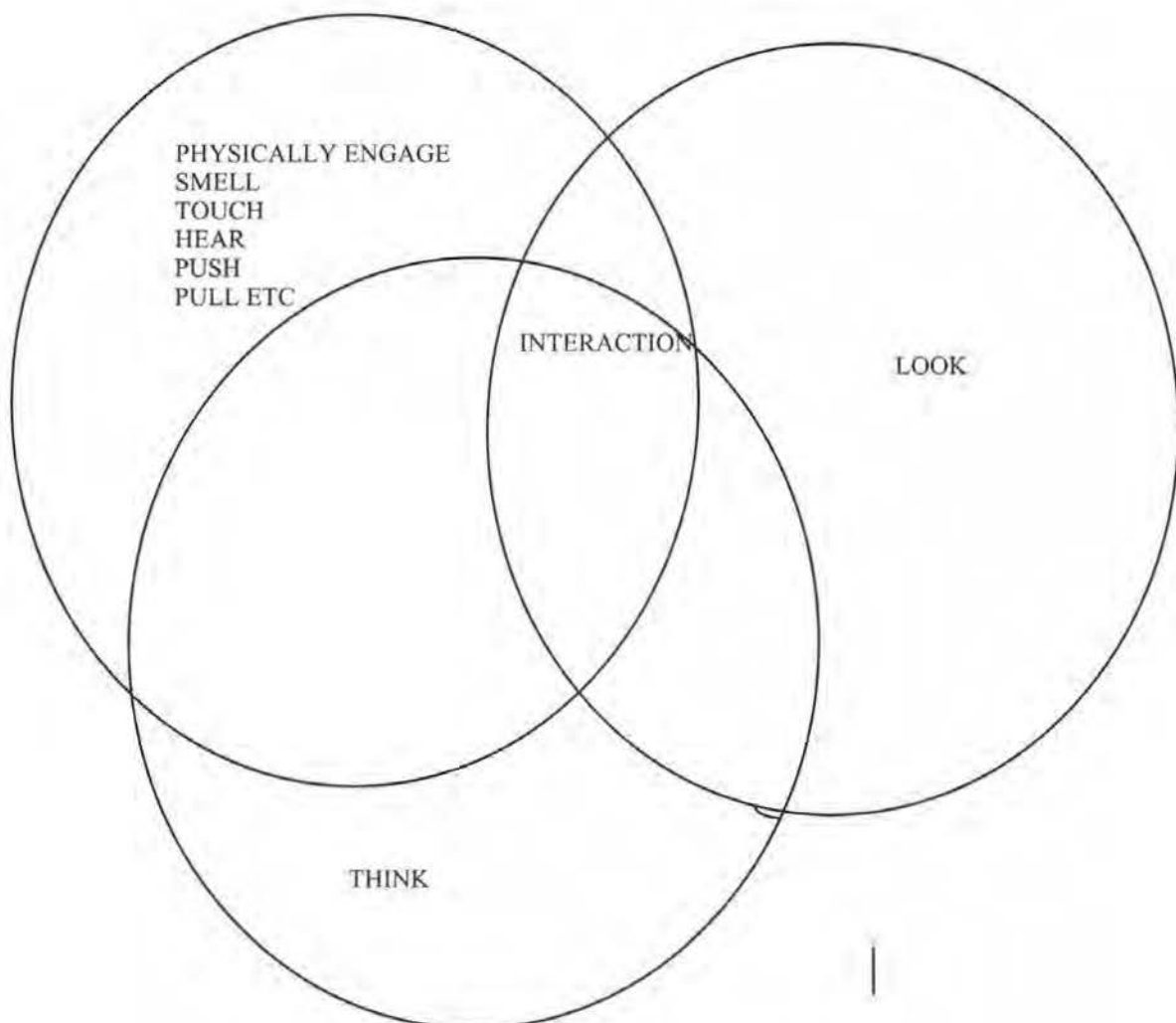


Figure 1 Interactions at animal exhibits.

- designed e.g. classification, variety of life, movements, adaptation;
- how they interpret the exhibits;
- what catches their attention;
- the curriculum focus of the school visits - whether the visit is being used for overt science education with the teachers;
- whether the exhibits provide cues to develop the pupil's learning about animals

- and associated concepts such as the environment and conservation.
- whether teachers use the exhibits to teach the children. Do teachers (or other accompanying adults) read the labels to the children and help their pupils identify with which they are referring to? Do the adults ask the children learning questions? Do they initiate a learning dialogue?

FACTORS AFFECTING A VISIT ENCOUNTER

VISITOR ZONE (RECEIVE FROM MUSEUM BUT GIVE TO SELVES)	VISITOR ZONE (RECEIVE FROM MUSEUM BUT GIVE TO SELVES)	MUSEUM ZONE (TRANSMIT TO VISITORS)
What the visitors already <i>know</i> about topic	The exhibit- its attractor factors:- Physical features—colour, size Value—monetary and emotional realness Links with visitors	The message of: museum designer curator others e.g. sponsors
In what they are <i>interested</i>	How close can they get	How message is tried to be given- insurrections/labels
The <i>task</i> visitors has at exhibit	What sensory stimulants are used?	
<i>Visit rationale</i>	Planned physical interactions	Mission of museum as in this exhibit
<i>Space</i> for visitors around exhibit	Views of exhibit according to position	Size and other spatial dimensions other physical features Site of exhibit background ambience- music, decor, seating
<i>Social groups</i> in which exhibit is viewed	Opportunities for group discussion	How designer planned visitor to interact see touch hear move
<i>Age</i> of group members	Is shared looking etc. possible	Is message layered?
<i>Time budget</i>	Are there opportunities for triggered talk? Are they used?	Other planned interaction explainers, CD Rom self guided tours, guide books
<i>Route</i> they take	Can exhibit be viewed at a number of levels of interaction?	
Stage of visit when they encounter specific exhibit	Are visitors using cues to explore the exhibit?	
Visitors <i>use</i> of facility		

Aspects of visitors' responses to exhibit	Data obtained from study of a whole visit	Data collected during part of a visit at individual and unrelated exhibits individual and unrelated exhibits
Behaviour of visitors	Tracking (Melton 1936) Intervention Studies (Taylor 1993)	Timing at exhibits (Falk, 1982, 83) Visitor Studies (Riddle 1980)
'Learning' focused on the process	Listening - in (Cooper 1995) Tunncliffe (in Prologue in 1995)	Listening - in (McManus 1987) Observations (Tulley and Lucas 1991)
'Learning' - focused on the product or outcome in terms of what is noticed or what is remembered	Memory prompt and recollection studies (Stephenson 1991) Pre and post testing (Linn 1980)	Intervention Studies by 'museum 'expert' (Tulley and Lucas 1991) Listening-in (Tunncliffe 1995)

Table 1 Summary of research methodology used in visitor studies

Category of Behaviour	Action	Resultant Interaction With Exhibit
WALK PAST	Minimal visual interaction or ignore	No effective interaction
PASSING COMMENT	Walk by but remark on some feature	Slight interaction Slight response to message of exhibit. Choose to ignore
EXPLORE	Stop. interpret features using own experiences, 'expert of everyday'	Direct interaction by talking to animal, touching exhibit, seeking a response aware of noises etc. of exhibit
STUDY	Stop. Interpret using message of exhibit or own story	Mental interaction- through physical movements and talk- Show and tell Re-enact or teach back.

Table 2 Range of visitor behaviour at exhibits

All animals, as exhibits, be they alive, preserved or animatronics are but 'images'. How can we find out about attention and learning of visitors to these images? Various techniques that have been employed to learn about visitor behaviour, the process of visitors' learning or the product or outcome of

the exhibit encounter. Listening in' (Cooper, 1995) and part-visit listening, (McManus, 1987), timing at exhibit, (Falk, 1982, 83), intervention studies, (Taylor, 1993), memory prompts and recollection studies (Stevenson, 1991) and observations (Tulley and Lucas, 1991). If we are to find out in which topics

visitors are interested when they look at animals as exhibits, we need to devise a technique for so doing. Analysing the content of conversations of visitors is a useful method (Tunnicliffe, 1995). Likewise there are a range of behaviors shown by visitors at exhibits. These are summarised in Table 2.

We can analyse the talking which occurs. Such a process gives us insight into responses of visitors and helps us gauge the importance of museum animals to the visitors with whom we are concerned.

The levels of talking which I have observed at museum animals are shown below. The data also shows that there are three levels of dialogue in terms of focus of the content and the form and function of the exchanges.

These are:

Level 1	<i>social</i> - which could occur anywhere and are unrelated to the animals;	
Level 2	<i>prescience observations and comments</i> - which occur in everyday conversations as people categorise their observations;	
Level 3	<i>pedagogic/ science dialogue</i> - through which one person is trying to teach another about the focus of their observations. This in turn has three levels:	1. <i>Ostensive</i> - where the child's attention is drawn to an object and an appropriate piece of information provided by another, or the child responds with a focused observation.
		2. <i>Directed commentary</i> - didactic or declarative information linked with the object. This commentary may include question-answer sequences but all at an observational or direct recall level e.g. What is that animal? What does it eat?
		3. <i>Logical discourse</i> . This involves the visitor, child or adult, in abstract thought and in justifying the statements that s/he makes. e.g. Teacher: What is that ? Response: 'It is a reptile' (level 2 comment) Question: 'Why? response (<i>because understood</i>) It has a dry scaly skin' . Alternatively a child may introduce logical discourse e.g. 'It is not snake it is a lizard <i>because</i> it has legs'.

In order to assess the responses of visitors we need to observe them and their physical actions as well as listen to them. How can this be effectively be? We can watch and listen. I consider that there are three level of encounter and each one of these is assessed in several ways.

In the research findings reported in this paper conversations were listened to and analysed. Other observations of visitors were not made.

METHODOLOGY

This descriptive ethnographic study was concerned with providing and explaining the observations collected in the zoo and museum. The research was not seeking to manipulate the experience of the children but to listen to their conversations. I recorded the conversations in person, by using a hand-held microphone, and moving with the children as

they walked around exhibits. I stood behind groups of children who did not know they were being recorded although permission had been sought from the teacher in charge. In some cases I followed the children from exhibit to exhibit until the group had a break and in other instances, e.g. in the Creepy Crawlies Gallery in the Museum or the Giant Panda at the Zoo, I stood at the exhibits in turn and recorded different groups as they viewed. The name of the school was requested but the anonymity of the participants was preserved. Where it was possible schools were selected so that there was a spread of the primary age range and the type of animal observed. The demographics of the schools visiting both locations were similar, although by its nature, the study was not an experimental analysis assigning groups at random to treatments.

Units of conversations provided the raw data of this study. A unit is defined as the 'group

FIRST LEVEL PHYSICAL — actions

WHAT DO THEY DO?

Count how many exhibits visited
Time at each exhibit etc.
Track path (and time too)
Observe - schedule or video

SECOND LEVEL — expressed models

What do they say?

MENTAL SPONTANEOUS TALK

eaves dropping, recording, radio mikes

INTERVIEW RESPONSES

before

after

both

time lapse later

THIRD LEVEL

INTEGRATED

Talk

observe

interview

conversation' at any one exhibit from the start of the viewing to their moving away'. The transcribed conversations provide qualitative data but because quantifiable data is an extremely useful and meaningful descriptive tool, a means of converting into this was sought. A systemic network was drawn up. This is a means of grouping or categorising things, in this case conversations (Bliss, Monk and Ogborn 1983), to be parsimonious

representation of the data, whilst preserving the relationships between categories in such a way that comparisons can be made between groups. The network can be regarded as the sets of boxes into which the researcher puts each part of the conversation. At one extreme of the continuum of categorising the conversations are highly specific items identified as terminals in the network and numbered. The terminal numbers at the right of the figure are the most

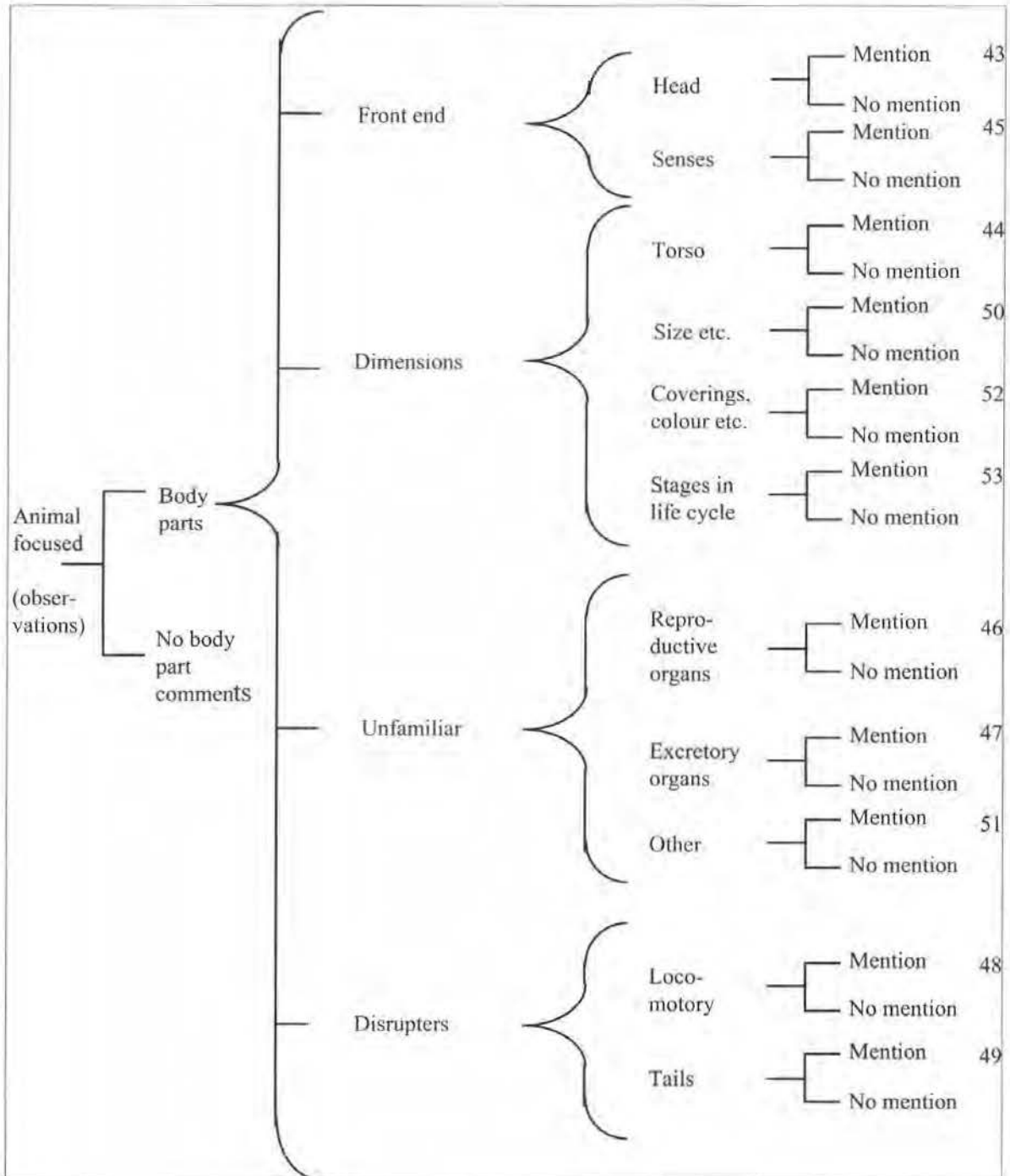


Figure 2: Body parts Segment of network

specific level of table categorisation and a category was either 'mentioned' or 'not mentioned'. At the other end is the main descriptor, in this case 'children's comments' (see fig 1). Terminals are grouped into superordinate categories. For example head, torso, sense organs and other comments about body parts each have a terminal number but are grouped in the Body Parts category. 'Body parts' is a subordinate category of Direct Animal comments which is a category of comments at animal exhibits.]

In the diagrammatic representation of the network (fig 2) a bar, '|', indicates that an attribute may or may not be a member of the subordinate categories, whilst a bracket, '{}', indicates that the comment categories are not mutually exclusive. Hence, a conversation either does or does not contain a direct reference to an animal (Bar categories). Direct comments about animals can be in one, two or all of the body part categories (bracketed categories). Further details of the theory and reliability of the network are in Tunnicliffe (1995).

The major categories of the network were 'affective attitudes', which included like (L) and dislike (D) comments and related noises (L- and D-noises), e.g. 'Ah!' or 'Urg'; 'exhibit comments' about the content of the exhibit and labels; 'welfare comments'; 'direct identification of the animal'; 'knowledge source' comments. These comments were questions or opinions or definite declarative statements together with reference to other knowledge sources such as TV, worksheets, books and lessons. The categories about the animal were divided into three, 'body part' e.g. shape, size, colour of the animals, head, legs; 'behavioural' comments referred to any actions of the animals such as feeding, moving, excreting; 'taxonomic comments', were those parts of the conversations which named the animals, e.g. 'Bird!', 'It's a cat!'.

Categories of other attitudinal comments were identified. The 'anthropomorphic' category contained explanations and comments about the animal in human terms, but not comments about structures such as, 'That chimp's hand is

Group of children according to age	Conversations in Zoo [n=459] shown for each age group	Number of conversations of age group expressed as % of total conversations	Conversations in Museum [n=407] shown for each age group	Number of conversations of age group expressed as % of total conversations
Group 1 (Five years & under-reception, nursery and kindergarten)	133	29	8	2
Group 2 (Year 1 & 2, six & seven year olds)	160	35	123	30
Group 3 (Year 3 and 4, eight & nine year olds)	84	18	77	19
Group 4 (Year 5 and 6, ten & eleven year olds)	39	9	186	46
Group 5 (Year 7, twelve year olds)	43	9	13	3

Table 3 Distribution of Children in Age Groups

like mine'. Comments which referred to human/animal interactions such as, 'Is it dangerous?'; 'I'd like to ride that animal', were grouped in a category whilst remarks related to the live or dead state of the animal were grouped in one category, 'animism'. Other descriptive demographic data such as the types of animal observed, the type of adult accompanying the group, were also recorded. Age was noted and the ages grouped.

Each conversation unit was scored with the appropriate number from the networks. The data was entered into a worksheet of a Minitab statistics package. There were 150 columns in the worksheet including all the terminals of the network and additional columns for demographic data and for the results of the consolidation of categories in the analysis of the data. A '1' was scored on the spreadsheet in each category of topic which was recorded in a conversation unit.

EXAMPLE OF ANALYSED UNIT OF CONVERSATION.

Location: Mammal Gallery 6 year olds

22 / 40 / 56

Teacher: The one/ over there/ is a cheetah.

56

Boy: Cheetah!

22 / 15 / 53

Boy 2: All these animals/ are real, / well they were,

3 / 70

Teacher: And yes , some of them / were very dangerous.

12

Boy : They're not now!

The overall categories of conversation are shown in tables 4 and 5.

All conversations heard at animal exhibits in the museum were about the exhibit. A break down of the of conversational content is shown in table 4 . The actual data are shown in table 6.

The predominant topic of comment heard is the naming of the specimen.

The animal focussed conversations are further subdivided as shown in table 5.

Consideration of the distribution of comments about a body part or behaviour showed that there were four categories of comment within each section. Comments about body parts can be grouped into four categories:

- the front end (head and sense organs), e.g. Eight year old girl at small primate said, 'They have a small nose and a small mouth';
- the body dimensions -shape size and colour; e.g. a five year old at the giraffe remarked "Is it really that tall?".
- unfamiliar bits , e.g. horns, excretory and reproductive organs particularly with unexpected colours, e.g. a seven year old boy remarked at the baboons, 'Look at their pink bottom!'
- disrupters ,which break the pattern of familiarity, e.g. tails, legs. An eleven year old girl at the elephants commented, ' Its got like a long nose'.

The four categories of behaviour comments are:

- movements, e.g. a seven year old at the gerunuk 'It looks as if it is stretching up'
- position in the enclosure e.g. this seven year old girl was telling her friend where to find a tortoise (turtle) Girl 1: You can see that, uhm, red thing, that red thing behind that rock. Girl 2 replied, 'Where up there ?';
- feeding e.g. eleven year old children looking at gerunuk , 'Look, its eating a branch';
- attention attractors. These are any activities, e.g. excretion, play, which are modelled in the position of the animal or a

EXHIBIT FOCUSED CATEGORIES	EXPLANATION
EXHIBIT ACCESS	Making sense of the exhibit and finding something to observe e.g. 'Look !' 'Where is it?'
EXHIBIT FOCUSED i. EXHIBIT SETTING ii ANIMAL FOCUSED	The 'exhibit furniture' and setting Observing the structures and behaviours of the animal and seeking to categorise it. (table 2)
MANAGEMENT	Organising the group by behaviour and dialogue e.g. 'Come here', 'Let's move on'
SOCIAL	Responses to conversations 'Yes', names and titles of individuals, 'Michael', 'Mum', 'Miss', so that the other categories of conversation flow smoothly, also 'irrelevant' social conversations incidental to animal exhibits, e.g. 'family gossip'

Table 4: Categories of Exhibit Focused Conversations

A. Direct animal focused conversation Topics	B. Indirect animal focused conversations Topics
1. Body Parts e.g. '.....at it's pink nose'	1. Memories ' We had bats in our garden ...'
2. Behaviours e.g. 'it's playing'	2. Plans ' We'll go and buy a book'
3. Names and relationships e.g.' It's a lizard'	
4. Affective and emotive attitudes to the animals 'Ah!, I like that'	
5. Enclosure observations and comments 'read on the label' 'under that log.'	
6. Interpretative comments e.g. 'I think it is a..' 'What is it?'	

Table 5: The Content of Animal Focused Conversation

physical feature e.g. eight year old boys at the bison (no longer on display) were fascinated by the seemingly patched bullet hole in the flank of the specimen.

The proportions of conversations about body parts and behaviours are shown in Tables 3 and 4 where the significance of the number of comments is expressed both as a proportion of

the total number of conversations but more importantly as *proportion of the category of body part conversations*. A contingency table was constructed for each category. The Chi-square was calculated with 1 degree of freedom.

The children in both sites expressed their preferences for animals in terms of liking,

disliking and the results of the count of such comments are given in table 6. Opinions about other aspects of the animals such as interpreting its behaviour in human terms were also expressed and the results of the count of conversations in which such a comment appeared at least once are given in Table 6.

The results provide an account of what interests these visitors, gauged through their

spontaneous conversations, when looking at animal exhibits. The zoo is more popular with school groups of younger primary aged children. The proportion of comments about the animals was similar in both locations except for a higher number of conversations with at least one comment about behaviours from observing the live animals and more comments about unfamiliar structures in the museum. There were significantly more

Main Categories of Conversations (topic heard at least once within conversation)	Zoo n=459	%	Museum n=407	%	Chi-square values (1DF) total conversation
Management / Social	354	77	270	66	12.46 p <0.005
Exhibit Access	289	63	219	54	7.46 p < 0.01
Exhibit Focus	459	100	407	100	N/A*
Other exhibits comments e.g. labels, furniture	227	50	220	54	1.18 not sig
Animal focused	458	100	405	100	N/A*
i. body parts	280	61	243	60	0.151 not sig
ii. behaviour	301	66	152	37	68.92 p <0.005
iii. names	401	87	344	86	1.45 not sig
Emotive attitudes	143	31	145	35	1.94 not sig.
Affective Attitudes [emotive + others)	193	42	219	54	11.96 p<0.005
Knowledge sources	254	55	296	72	28.15. p <0.005
* cell numbers insufficient to proceed with analysis					

Table 6 The Main categories of Conversation Topics (topic mentioned at least once in a conversation)

conversations containing at least one 'management and social' comment, 'exhibit access' and 'behaviour' comments at the zoo. The differences in attitude comments and knowledge source comments were also significant. More conversations that contained at least one comment related to sources of knowledge were made in the museum and more conversations mentioning affective attitudes, L or D comments and noises or noises in the 'other' category such as 'Oh', at least once were heard in the zoo. Other attitudes toward animals are significantly different in the two contexts. The museum visit elicits more comments about human domination or the effect the animal may have on the child, whilst the live animals stimulate anthropomorphic comments. Interestingly, the children in the museum comment about the 'realness' of the specimens significantly more

The data and my experience gained through working in many zoos and museums suggests that primary school and family visitors:

- need to identify the specimen to their satisfaction, not in accordance with scientific nomenclature or zoological taxonomy. These 'basic' terms used by visitors to name the animals are at genus, family, order, class and phylum level.
- rarely refer to labels unless they can not name the animal from within their own experience.
- come to the museum holding a basic concept of the animal that results in their remarking predominantly about the dimensions of the specimen; the head and sense organs; legs and tails and other items that disrupt the outline and a parts of the anatomy, such as excretory organs.
- comment about the behaviours, particularly the position of the animal in its enclosure, locomotory movement, feeding and any other behaviour such as parental care that attracts the attention of the observer.

The data from this study suggest that the collection of preserved animals affords a more educationally effective resource for helping

primary children construct an understanding about animals because of the nature of the exhibits and the perceived predisposition for learning within a museum.

The natural history collection offers visitors:

- the opportunity to view animals with ease.

The specimens are 'framed' within an exhibit, their location and behavioural position is known to visitors if they have made a pre visit.

This relative ease of accessing the exhibit and observing the animal specimens facilitates the observation and learning of criterial attributes for taxonomy and other aspects of biology.

School groups:

- make significantly fewer management and social comments in the museum
- discuss unfamiliar attributes significantly more (horns, reproductive and excretory organs for example).

Museum visitors discuss the behaviour of the animal, even though the animals are not alive, especially the behaviour portrayed in the scenario or position in which the animal is exhibited.

Over 1/3rd of school groups looking at the museum specimens commented about behaviour, at least once in a conversation; the rate is 2/3rds in the zoo.

Dioramas of mammals, based on listening at a number around the world in Natural History museums- are superior to just animals in a display case or mounted free standing and to live animals in zoo because they have an authentic background- i.e. naturalistic context in which they are viewed. There is both a spiritual, moral and cultural aspect to the dioramas too as well as the scientific. I consider them all just beautiful- the visitors want to 'read' the exhibits with their words/ language and, as the museum's role is to entice the visitors into reading the museum's story thus fulfills their mission.

The Natural History Museum elicits more

content about the animal specimens within the conversations of their visitors, school or family. That about which people speak is an indicator of the content of their thinking, which in turn reflects the topics about which they are interested.

Museums should build on this deeper observational level of activity amongst their visitors compared to the zoo experience and develop the observation of animal specimens into a learning encounter, based on the observations that we now know these visitors, primary school and family groups, generate.

It is however of interest that the basic pattern of content of comments is so similar, indicating that the visitors share a basic concept of animals about which they comment when observing animal exhibits, be it in a natural history museum or zoo. The challenge is to use this foundation of knowledge and construct the knowledge and understanding of visitors using the messages of the museum.

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Collecting Under Contract: Balancing The Needs Of Museum Reference Collections And The Requirements Of The 'Client'.

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Introduction

Museums are increasingly seeking to generate additional income through commercial contract work. This type of work often necessitates the collection and examination of comparatively large quantities of material. With staff shortages and limited resources being an issue in virtually all museums, there are obviously a number of important factors that need to be taken into consideration, ideally before such work is taken on. This paper examines the results of a staff discussion held in the Department of Zoology at the Natural History Museum (NHM) about increasing curatorial involvement in contract and consultancy work. The NHM's national cetacean strandings contract is used to illustrate the benefits and drawbacks of such work.