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6. CHILDREN'S ATTITUDES TOWARD SPECIMENS AT THE BEATY BIODIVERSITY MUSEUM

INTRODUCTION

As children are key learners in family groups (Falk, Moussouri, & Coulson, 1998; Briseño-Garzón, Anderson, & Anderson, 2007; Falk, Heimlich, & Bronnenkant, 2008) and school groups, it is valuable and essential to expand the research on children's aspects of learning in museums. Children's attitudes to museum exhibitions influence their experiences of learning in museums (Anderson, Piscitelli, Weier, Everett, & Tayler, 2002). Museums with live animals such as zoos and aquariums have a strong potential to induce emotional responses among visitors (Adelman, Falk, & James, 2000; Myers, Saunders, & Birjulin, 2004). However, unlike zoos and aquariums, natural history museums, with preserved animals on display, have the potential to evoke unpleasant and disturbing emotions among visitors, because the animals displayed are dead. This is an unavoidable intrinsic characteristic of natural history museums with preserved animal specimens. Live animals and preserved animal specimens may have a similar educational function in providing cognitive knowledge about animals, but the visitors' emotional responses induced by preserved animal specimens may be distinct from the emotions triggered by live animals. As a result, they may impact visitors' affective gain, which could have deeper and longer influences on visitors' memories, and may even last for decades (Anderson & Shimizu, 2007).

Although some psychologists believe that attitudes are both inherited (McGuire, 1985) and acquired (Maio, Esses, Arnold, & Olson, 2004), more researchers have supported the concept that attitudes are learned from the living environment. Maio and Haddock (2009) believe that the attitudes are generally constructed or influenced by three components: *cognitive* – the knowledge and information concerning the object related to the attitudes; *affective* – feelings and emotions associated with the object related to the attitudes; and *behavioural* – consisting of past experiences regarding the object related to the attitudes (Maio & Haddock, 2009). These tripartite components are interrelated (Haddock & Huskinson, 2004). Visitors' knowledge associated with the object may influence their feelings and attitudes, and their emotional connection with the object will

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influence their learning as well (Anderson et al., 2002). Overall, inquiring into children's attitudes towards displayed animal specimens is crucial and warrants further study.

One particular set of attitudes relevant to this study is children's attitudes towards death. Lazar and Torney-Purta's (1991) study of children's perception of death resulted in four aspects that defined and measured concepts of death; *irreversibility* – it is unchangeable, the dead can never come back; *cessation* – all biological, sensory, emotional and cognitive functions have ceased; *causality* – the objective causes of death; and *inevitability* – death is universal and inevitable, every living organism will die. Children from different ages may partially or entirely understand these concepts, but which concept(s) may influence their attitude toward specimens needs further research. Lazar and Torney-Purta (1991) found that children's understanding of the concepts of animal death and human death are developed differently and the concept of human death was better understood than animal death. Orbach, Gross, Glaubman, and Berman's (1985) study also found that children with more cognitive awareness of death were more likely to be influenced by their own anxiety.

However, specimens on display in museums not only represent death, but also represent that the animals were once alive. Children's attitudes toward animals are indivisible from the topic of a human-nature relationship. Research into relationships between human and non-human beings resulted in a hypothesis called *biophilia*, which refers to humans' affiliation with animals and natural environments (Wilson, 1984), and it not only includes people's positive attitudes towards non-human beings, but also includes human's negative affiliations with animals and natural environments (Kellert, 1993).

Kellert (1985a) developed his typology of people's attitudes to animals, and divided the responses into nine categories: naturalistic, ecologistic, humanistic, moralistic, scientistic, aesthetic, utilitarian, dominionistic and negativistic. The definitions of Kellert's (1985b) attitudes are summarized in Table 1. Kellert and Westervelt's (1983) research shows that the most common attitude of children to live animals is humanistic, which represents their interest and emotional connection for particular animals such as their pets or large wild animals with strong anthropomorphic association.

However, research into the use of specimens as educational museum exhibits, and in particular the research into children's perspectives of displayed animal specimens, is not as comprehensive as research into the attitudes people hold towards living animals. Similarly there is a lack of research into the use of animal specimens presented in a *touch table* format. Although not focused on attitudes specifically, Tunnicliffe's (1996) research into children's conversations about live zoo animals, specimens in natural history museum dioramas, and specimens in *nature tables* provides useful insights into children's knowledge about and attitudes towards animal specimens. Tunnicliffe's research comparing children's unprompted conversations about live animals at a zoo and taxidermies of animals in dioramas

Table 1. Kellert's (1985b) attitudes towards animals

Naturalistic	Primary interest and affection for wildlife and the outdoors.
Ecologistic	Primary concern for the environment as a system, for interrelationships between wildlife species and natural habitats.
Humanistic	Primary interest and strong affection for individual animals, principally pets. Regarding wildlife, focus on large attractive animals with strong anthropomorphic associations.
Moralistic	Primary concern for the right and wrong treatment of animals, with strong opposition to exploitation of and cruelty toward animals.
Scientistic	Primary interest in the physical attributes and biological functioning of animals.
Aesthetic	Primary interest in the artistic and symbolic characteristics of animals.
Utilitarian	Primary concern for the practical and material value of animals.
Dominionistic	Primary satisfactions derived from mastery and control over animals typically in sporting situations.
Negativistic	Primary orientation is an avoidance of animals due either to indifference, dislike or fear.

in a natural history museum demonstrated no significant difference between the general content of the conversations in these two groups. She did, however, find subtle differences between the emphasis of the conversations between boys and girls, with girls making significantly more comments reflecting affective attitudes and using more emotive comments than boys.

Research into children's reactions to prepared animal specimens presented outside of the context of a diorama exhibit is minimal. Tompkins and Tunnicliffe's (2007) study of children's responses to a *nature table*, a table of objects from nature displayed in the classroom, provides insights to children's ideas about animal specimens. Their research documents how young children (ages 5–10) use science process skills such as observation, analysis and inference when discussing specimens. In particular, the concept of animacy, in which children's conversations about objects such as a snail shell or bird feather would relate to the living snail or bird was a limitation. As a result of their research they also recommend criteria including animacy, novelty, familiarity, aesthetics and emotional engagement when selecting items for a nature table.

There are emergent needs for in-depth studies about children's attitudes towards specimens. This study begins to address this gap by examining children's attitudes towards preserved animal specimens. Additionally, it attempts to articulate for both visitors and museum educators the value of potentially unpleasant characteristics of specimens and how this kind of knowledge may support visitors' learning and intensify their understanding of conservation. The research was guided by the following questions:

1. What do children know about museum specimens and the live animals they represent?
2. What characteristics of the preserved animal specimens influence children's reactions towards them?
3. What kind of attitudes do children express towards preserved animal specimens?

METHODOLOGY

This research was conducted at the Beaty Biodiversity Museum, Vancouver, (www.beatymuseum.ubc.ca), which displays the University of British Columbia's six natural history collections, comprised of more than two million specimens, including a treasured 26-metre-long blue whale skeleton. The museum's exhibits portray how scientists use the vast collection to better understand biodiversity.

The philosophical approach of this research was phenomenography (Marton, 1986), as it attempted to investigate the qualitatively different ways in which children experience and think about animal specimens. In order to look more deeply into children's complex views and ideas about preserved animals, and give more freedom to their cognitive and emotional process, semi-structured interviews and participant observations were employed (Creswell, 2009, p. 8).

Participants

The targeted demographic of this research was children (5–14 years old) within family groups who were capable of explicitly expressing their feelings about a specimen and clearly understood the requirements of the questions asked. A total of 40 children, 21 females, 19 males, participated in this research. Most children (32 of the 40 participants) said that they had a pet or pets at home.

Data Collection

Two kinds of qualitative research approaches were used to collect data: semi-structured interviews and participant observations. These methods enabled the researcher to gather more in-depth information about the children's personal experiences during their visit (interview) and assess a wider range of factors which may influence children's attitudes to specimens. At the same time, by applying these two strategies, the researcher was able to triangulate the data during data analysis.

Semi-structured interviews. Forty children were interviewed at the Beaty Biodiversity Museum. The short interviews (approximately 15 minutes) were semi-structured and led by several prepared open-ended questions. The questions explored three aspects: cognitive knowledge of the specimen, emotional connections with or feelings about the specimen, and past experiences with the specimen or its live

animal counterpart. The interviews were audiorecorded and the interview transcripts were used in data analysis.

Participant observations. Participant observation was used to "investigate, experience and represent the social life and social processes that occur in that setting" (Emerson, 2001, p. 352). The aim of the observation was to record the body language, facial expressions and interactions with specimens during the interview, particularly focusing on how the behaviours contradicted their oral responses in the interviews. Background information was noted, such as whether the children had participated in any museum educational activities, or whether they accidentally overheard the research questions and the answers from other participants, as well as unexpected influences such as parent interference, museum tours, and children's potential disruption of the specimens.

Research Procedures

Family groups were approached during their visit to the museum. After the researcher introduced the research objectives and the purpose of the research project, care-givers and their children were asked if they would like to participate in the research and adults were given a consent form to sign.

During the interviews, participants were shown a range of specimens on a *touch table*, an approach commonly used by museum educators to engage visitors in discussions. The specimens included taxidermies of a robin, crow, rat, raccoon, a dried porcupine fish (also mistakenly recognized as a puffer fish), a long-fin mako shark jaw, a grizzly bear skull and a preserved clown fish in formaldehyde (Figure 1).

Figure 1. The specimen touch table used in interviews

The following interview questions were asked while showing the specimens to participants:

1. Can you recognize these specimens?
2. What do you know about these specimens?
3. What do you feel about these specimens, and why?

4. Would you like to touch these specimens? Why or why not?
5. Have you ever seen these animals/specimens before?
6. Which of these specimens do you like/dislike the most? Why?
7. Do you have a pet at home?

Data Analysis

All audio-recorded interviews were transcribed and observations annotated and coded. The process of coding summarized and categorized all the collected research materials (Creswell, 2009). The information about children's attitudes towards preserved animal specimens was categorized using Kellert's (1985a) attitudes: naturalistic, ecologistic, humanistic, moralistic, scientistic, aesthetic, utilitarian, dominionistic and negativistic.

Ethical Considerations

Interviewing children is a complicated approach to research because of the sensitivity of children's emotions and the possibility of unintentionally causing distress in the children during the interview. The unpleasant intrinsic nature of the concept of death is a sensitive topic to discuss with children. Consequently, extra attention was paid to the wording of the prepared questions, and permission was granted by their caregivers to discuss these concepts before the interview.

OUTCOMES

Attitude is determined by an individual's cognitive knowledge, feelings and past experiences of the object. Children's responses including knowledge, experience and feelings related to the specimens and of the corresponding live animal of the specimen; the characteristics of the specimens that most influence participants; and, their attitudes towards specimens are introduced below.

A response was coded as recognized when children identified the specimen by name. None of the participants identified the porcupine fish by its correct name, but used its more common name of puffer fish. Considering the aim of this research, the researcher accepted puffer fish as the correct name for the specimen. As Figure 2 shows, participants readily identified most specimens, with the exception of the bear skull, which was identified by only nine children (23%).

Children's Knowledge about Specimens

Children had little knowledge about the specimens. As exemplified in the following excerpt, when answering the question, "What do you know about these specimens?" they tended to respond with their knowledge of the live animal the specimen represents. Some of the knowledge the children shared about the live animals

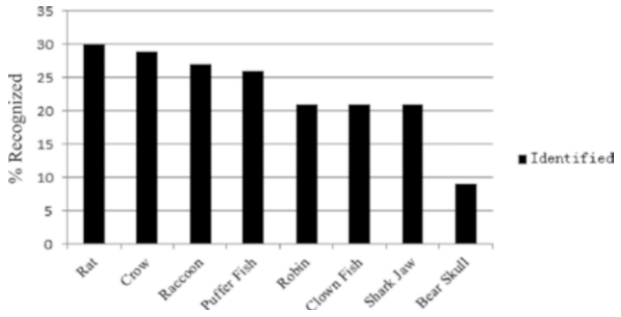

Figure 2. The recognizability of specimens. (n=40)

was quite complex. Nine (22.5%) of the participants demonstrated more complex knowledge about the porcupine fish, such as "it puffs up when it get scared", and "there is poison inside of the fish." Four (10%) of the participants showed in depth knowledge about the shark, such as "people use shark fin soup", and "sharks are predators".

Researcher: What do you know about these specimens?
Child: The puffer fish has poison inside, and will kill a human within like five minutes.
(*seven-year-old, male, a bunny as pet*)

During the interviews, participants were provided opportunities to think and talk about the specimens. The participants illustrated science process skills by using observation skills to gather information, describing the characteristics of the specimen and making inferences based on their observations.

Researcher: Can you recognize these specimens?
Child: That's looks like a jaw of a shark, I think according to its teeth, I think its white [great white shark].
Researcher: What do you think about these specimens, are they real or fake?
Child: I think some of them are fake and some of them are real. I think those ones with the weird looking eyes are fake [the specimens without eyes], because that will prove they are just stuffed animals or something. The puffer fish is a spike ball, I could choose the white jaw, because of its shinning teeth, it might be a fake, but I am pretty sure it's real, and because of its weird looking bone-ish colour and shape, I believe those three are real [bear skull, shark jaw, puffer fish].
Researcher: You think these [raccoon, crow, rat] are fake because they do not have eyes?
Child: Yes, and this robin, probably. It's fake too.

Researcher: But it has eyes?
Child: This robin is paralyzed, and usually the robin will just usually swing down, so it's paralysed. You can grip on it and tell it's fake. (*eight-year-old, male, no pet*)

Children's understanding of death. All participants in the study had the cognitive awareness of the death of the specimens to some extent. As the excerpts from interviews below illustrate, most participants related the concept of specimen with the concept of death.

Researcher: Do you think these specimens are dead or alive?
Child: They are all dead, they are not moving! And the puffer fish is not [either]… it could not be alive! (*eight-year-old, male, no pet*)

Researcher: What do you know about these specimens?
Child: You mean these animals or these specimens?
Researcher: The specimens, are they alive?
Father: Of course dead, she said "specimens".
Child: I know "specimen" – specimens are all dead! (*11-year-old, female, has a dog and two fish as pets*)

However, three participants were not certain whether a specimen was dead, but could give explanations once this was confirmed.

Researcher: What do you know about this clown fish?
Child: Is it dead?
Researcher: Yes.
Child: If it's sideways or upside down, they are dead. But sometimes they pretend they are dead. (*seven-year-old, male, has a cat as pet*)

Two participants who were interviewed together had the awareness of the death of the specimens, but showed low awareness of the concept of the irreversibility of death.

Researcher: What do you feel about these specimens?
Children: Raccoon scares me, because if this one is going to move, I think it looks awful.
Mother: Like a zombie?
Participants: Yeah.
Researcher: Do you want to touch them?
Children: I do not want to touch, because I am scared, I think they are going to get alive. (*seven-year-old, male; nine-year-old, female; two cats and a dog as pet*)

Experiences related to live animals. All participants reported that they had direct experiences with robins, crows and raccoons. A few participants had direct experience with bears and rats. They had seen these animals in the wild and in their daily life. One of the participants (10-year-old, female) had a pet rat. She was the only participant to touch the rat specimen during the interview and, interestingly, it was the only specimen she touched. Some participants had seen porcupine fish, clown fish, sharks, and bears at an aquarium or zoo. Most participants had indirect experiences with clown fish as it appeared in movies and popular media.

Children's feelings towards specimens. One participant did not respond to the question, therefore data related to feelings towards specimens was collected from 39 of the 40 participants. The top three specimens participants liked the most were robin (n=21), porcupine fish (n=12) and shark jaw (n=6). The top three they disliked the most were rat (n=11), porcupine fish (n=6) and shark jaw (n=5) (Figure 3).

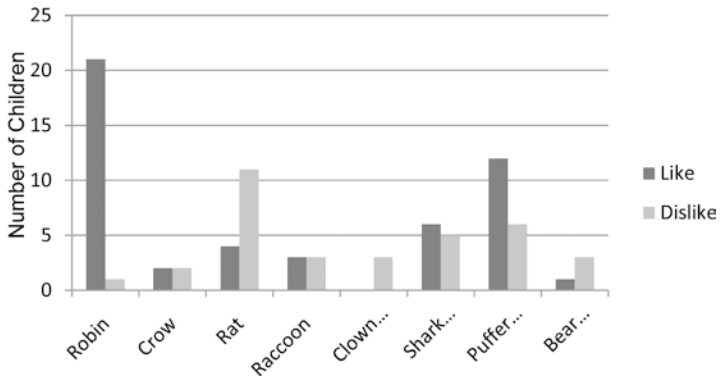

Figure 3. Children's choice of liked and disliked specimens

The emotional reactions children had to specimens were diverse (Table 2). Children used two approaches to describe their feelings. In one approach children described their own emotional reactions triggered by the specimens. Twenty-seven participants used only the emotional descriptors when describing their feelings towards the specimens. Within this group there was a marked difference in gender, with the majority (63%) of this group being girls. The other approach was to use more descriptive or tactile terms related to the characteristics of specimens. Only three participants used this approach, and all of them were boys. Some participants even described elements they could not physically sense at that moment such as smells and perceived cleanliness. Nine participants used both the descriptive and emotional terms to describe their feelings towards the specimens.

Table 2. Descriptive word use by children

Category	*Descriptor*
Emotional	Freaky, afraid, scary, creepy, crazy, dumb, lame, weird, awful, gross, yucky, disgusting, annoying, silly, deadly, boring, nothing dangerous, cool, cute, funny, friendly, like, sorry, happy, interesting, sad, bad.
Descriptive	Fluffy, soft, feathery, fury, spiky, spooky, pointy, sharp, slimy, smooth, shiny, hard, woody, wet, ugly, smells, rough, pretty, beautiful, colourful, paralyzed, fast, tiny, small, big, huge, fat, not clean.

Influential Characteristics of Specimens

Based on the frequency of comments from participants, the following are the three most influential characteristics of specimens: (a) tactile impressions, (b) specimen damage, and (c) unique characteristics, including visible traces of the specimen preparation process.

Tactile impression. The majority of participants (82.5%) touched the specimens and described their tactile impressions. If the specimen was soft, such as the raccoon and the robin, the participants tended to have more physical contact with the specimen. How the specimen felt became participants' reasons to like or dislike it. Eight participants said they liked the robin and racoon because they felt soft; three participants disliked the porcupine fish and shark jaw because they felt pointy or sharp.

Specimen damage. Some specimens used in this research were partially broken or damaged, such as the grizzly bear skull's missing teeth, broken spikes on the porcupine fish and the clown fish's washed out colour. Participants showed curiosity towards the missing teeth of the grizzly bear and the broken spines of the porcupine fish. Their questions about the damage were related to confirming their thinking about whether the specimen was dead or whether the specimen was real, finding the "criminal" who damaged the specimens, and searching for the cause of the damage. Almost half the participants did not recognize the clown fish. After they were told the specimen was a clown fish or *Nemo*, the clown fish character in a popular children's movie, the participants started to look more closely at it and asked questions about the faded colour.

Researcher: Can you recognize these specimens?
Children: A robin, crow, rat, raccoon, a fish…
Researcher: You could have a close look at it.
Children: Is it the kind that is in the movie *Finding Nemo*? What's it called?
Researcher: Clown fish.
Children: Oh! Where are its stripes?
(*nine-year-old, seven-year-old, females, no pet*)

Unique characteristics. Participants were attracted by unique characteristics that make the specimens different from their living counterpart, particularly the visible traces left by the specimen preparation process. For some specimens these characteristics were apparent to the children such as the missing eyes on the racoon, crow and rat, the unfamiliar pose of the robin, and the hollow nature of the porcupine fish. These characteristics attracted participant's attention and even triggered questions.

Researcher: [Pointing at the rat] actually, this one is a rat.
Child: A mouse are pretty much looks the same any way. Hey! What happened to their eyes? It seems creepy!
(*eight-year-old, male, no pet*)

The visible traces of the specimen preparation process always triggered participants' curiosity. The questions they asked during the interview were mainly around these traces. Three of the traces most frequently mentioned by children participants were the stitching on the porcupine fish, the lack of eyes on some specimens, and the fact that the clown fish was in a jar. Also, one participant responded that the faded colour of the clown fish made it hard to recognize.

Children's Attitudes Towards Specimens

Children's attitudes toward specimens are determined by their cognitive knowledge, feelings, and past experiences with the specimens. However, their feelings towards the specimens may differ from their feelings towards the live animal. Using Kellert's (1985a) categories of attitudes toward live animals as a lens through which to analyze the children's reactions reveals a few differences.

As Table 3 illustrates, children's conversations reveal a range of attitudes towards the specimens. Examples of all Kellert's categories with the exception of ecologistic were found in this research. In addition to Kellert's categories, three children also showed attitudes that had a more sympathetic perspective. This attitude was often expressed in relation to the children's awareness of the death of the specimens. They expressed this sympathy through statements such as, "I kind [of] feel sorry for them, because they are all dead", "Sad, they are all dead, nothing else", "Not scary, but feel sorry". In these responses, participants illustrated their awareness that they regarded the specimens as animals not objects.

DISCUSSION

An individual's attitude is constructed by three components: their cognitive knowledge, emotional reactions and past experience with the object (Maio et al., 2004). As there is limited research into attitudes towards specimens, and in particular specimens presented in the context of a research-based natural history museum, this study takes important first steps towards understanding children's attitudes towards

Table 3. Children's attitudes toward specimens

Categories	*Definition*	*Participants' Responses*
Naturalistic	Primary interest and affection for wild life and the outdoors.	"I kind of like all of them."
Humanistic	Primary interest and strong affection for individual animals, principally pets. Regarding wildlife, focus on large attractive animals with strong anthropomorphic.	One of the participants just touched the rat specimen, she had two rats as pets at home, and she said she only liked the rat among all the presented specimens.
Moralistic	Primary concern for the right and wrong treatment of animals, with strong opposition to exploitation of and cruelty toward animals.	"They use shark fin soup, which I think is wrong. They just cut off the fins. If they use the whole shark, I mean it's OK…"
Scientistic	Primary interest in the physical attributes and biological functioning of animals.	"It [shark] is a pretty big predator."
Aesthetic	Primary interest in the artistic and symbolic characteristics of animals.	"I like the robin because it is beautiful."
Utilitarian	Primary concern for the practical and material value of animals.	"When it [porcupine fish] puffs up, you could use it as a ball."
Dominionistic	Primary satisfactions derived from mastery and control over animals, typically in sporting situations.	"They are all dead, nothing dangerous." "You could see them close, if they are alive, you cannot really do that."
Negativistic	Primary orientation is an avoidance of specimens due either to indifference, dislike or fear.	"The rat is disgusting."
Sympathetic	Primary emotion due to the awareness of the death of the specimen.	"I kind [of] feel sorry for them, because they are all dead."

animal specimens and the opportunities that using specimens presents to museum educators to further their educational objectives.

Children's Knowledge about Specimens

This study begins to explore an area where there is limited research specific to the use of specimens as an educational tool. Tunnicliffe's (1996) research into children's conversations at natural history museum dioramas provides valuable

insights into children's reactions to individual specimens used in a common *touch table* format. Even though their experiences with specimens were limited and most of the participants had never visited the Beaty Biodiversity Museum, most children could identify most of the specimens. Although all children reported that they had direct experience with animals they may see in their daily lives such as the rat, crow, racoon and robin, not every child was able to identify them by name. Even when children could not identify specimens by name they demonstrated a series of science skills, in particular observation, analysis and inference, when discussing the specimens (Tompkins & Tunnicliffe, 2007).

Participants showed strong interest in the dried porcupine fish and shark jaw. Interestingly, children in this research chose these specimens as both the top three most popular and unpopular specimens. Participants also demonstrated more in depth and complex knowledge about the porcupine fish and the shark than other specimens. Although, these specimens were rated as both the most favourable and most unfavourable specimens, the results still partially agreed with the result in the prior research, which showed that children had better knowledge of, but less favourable attitudes toward, unpopular animals compared with popular animals (Prokop & Tunnicliffe, 2010).

More female participants use emotional words to describe their feelings regarding the specimens than male participants. They made more emotional connections to the specimens than male participants. This is consistent with Tunnicliffe's (1996) study in which girls made more affective and emotive comments than did boys. From observations, female participants also had more physical contact with the specimens.

Children have stronger emotional responses to the specimens that they have better knowledge of; eleven children in this research demonstrated more knowledge about the most popular and unpopular specimens. This general trend is contradicted by reactions to the robin specimen, a common bird in the area. Although all participants stated that they had experience with robins (75% identified it by name and over half the participants stated they liked the robin specimen), few of them had much knowledge about live robins or the robin specimen. This could be because participants were attracted by the pleasing aesthetic of the specimen, and yet the participants' familiarity with robins in their surroundings and their lack of novelty sparked little curiosity to learn more about it (Tomkins & Tunnicliffe, 2007).

When asked about the specimens, children generally relayed knowledge specific to the live animal counterpart, not information specific to the specimen. Even the few participants, who owned specimens (shark jaw or a single shark tooth) talked about the live animals rather than the preserved specimens. This is reflective of Tomkins and Tunnicliffe's (2007) discussion of the role of animacy in children's perceptions of specimens. During these conversations children seem to use the specimens as a starting point for discussing the live animal. This connection could have important consequences for the use of specimens as an educational tool. The exceptions to talking about the live animal related to the specimen occurred when children noticed features on the specimens either related to damage of the specimen or visible signs

of the specimen preparation process (addressed in the following section), or when more challenging concepts where being discussed, such as whether the specimen was real or fake, or dead or alive.

Anecdotally, museum educators often report children using terms such as real, fake and alive when asking questions about specimens, and this is supported in Tunnicliffe's (2007) research into children's conversations about animals in dioramas. In this study, children made quite decisive statements about whether a specimen was real or fake. These comments were often made when discussing specimens that were missing key features of the live animal, such as eyes. Children in the study had an understanding of death of the specimens to some extent. Their understanding of the sub-concept of cessation (Lazar & Torney-Purta, 1991) seemed to be related to the specimen's lack of movement. However, two participants' (9 year old females) understandings of the irreversibility of death were low. They seemed to need to be reassured that the animal would not come back to life before they shared further information, and in one case her concern seemed to create fear towards the specimen. This is consistent with Lazar and Torney-Purta's (1991) findings that children do not necessarily understand the sub-concepts of death as they relate to animals, other than cessation, very well.

Influential Characteristics of Specimens

Specific characteristics of the specimens in the study seemed to influence the children's reactions and may contribute towards their attitude towards the specimens. This finding is consistent with Tompkins and Tunnicliffe's (2007) criteria for selecting natural objects for teaching. They suggest that items with an aesthetic appeal, including texture, items with a novel appearance and objects that elicits an affective response are more likely to attract children's attention.

The specimens in this study presented a range of tactile experiences for children, from the softness of animal fur and feathers to the sharpness of shark's teeth and the protective spines of the porcupine fish. Tactile impressions, such as the softness of the animal fur, attracted children to have direct contact with the specimens. Previous research showed that soft tactile impression provides a sense of safety (Harlow, 1958). It also provided an enjoyable affective experience for the participants. Different kinds of tactile impressions of the specimens provide museum educators with an opportunity to discuss topics about the functions of different parts of animals' bodies, such as sharp teeth for hunting, and provide a valuable cognitive experience of having a close observation of an aggressive predator's giant mouth without being attacked.

The unique differences between the specimens and the live animals the specimens represent reflect the novelty that Tomkins and Tunnicliffe (2007) describe and are triggers for children's curiosity. Unconsciously, the researcher tended to avoid specifically referring to the damage on some of the specimens, but the participants were often curious about the damage. Their questions about the damage seemed to reflect a moralistic attitude (Kellert, 1993) towards the specimen and the person who

caused the damage. Children were also attracted by features related to the processing of the specimens, such as the absence of eyes, fake eyes, or visible stitching.

Children's curiosity and interest about these features of the specimens could provide museum educators an opportunity to deliver information about specimen protection. Museum educators could facilitate scientific, utilitarian and aesthetic considerations of the specimens.

Children's Attitudes Towards Specimens

The specimens seemed more like mediators to elicit participants' knowledge of live animals. The findings suggest that children's attitudes towards specimens are related to the specimens' appearance and the children's interests in the live animals the specimens represented. Children tended to show stronger affection towards specimens with pleasing aesthetic characteristics as illustrated by children touching and standing closer to specimens they thought were beautiful, soft or cool. If they had some knowledge about the specimen or the animal of the specimen, the attitude showed by participants was more complex, as exemplified by one girl who had a pet rat at home she described the rat as "soft and cute" and touched only the rat specimen during the interview. Having pets at home was associated with positive attitudes towards, and better knowledge about both popular (robin) and unpopular (rat) animals in general (Prokop & Tunnicliffe, 2010). These results are also supported by prior research, which showed that positive affect were correlated with the exhibitions which visitors could connect with their pre-existing knowledge and understandings (Piscitelli & Anderson, 2001).

Participants' attitudes toward specimens shown in this research are similar to Kellert's (1985a) categorization of children's attitudes towards animals. In addition to the child's knowledge of the living animal, the physical condition of the specimen and the fact that it is dead seemed to generate a range of attitudes towards it. Participants' awareness of the concept of death of the specimens seemed to influence some children to feel more in control and express more dominionistic attitudes toward specimens. They were confident to touch the specimens and they showed appreciation and satisfaction for the opportunity for direct contact. Meanwhile, the negativistic attitudes toward specimens showed by children were different from what they recalled about the live animals. They may show avoidance of touching a specific specimen, but they also claimed they liked the specimen, but just did not want to touch it. In contrast, children may also claim a negative emotion towards a specific specimen, while being willing to touch it. Although most of the children reported they felt the specimens were scary and creepy, many were willing to touch or at least stand close to the specimens. They actually showed less fear than they described. Additionally, they also showed a humanistic attitude to the specimens.

Children did not seem to express any ecologistic attitudes (Kellert, 1985a). This is not surprising given the context of the study; a research-based collection with limited diorama-like exhibits displaying specimens in an environment, and unrelated specimens exhibited on a table.

In addition to Kellert's (1985a) nine categories of attitudes, participants seemed to illustrate an additional attitude, sympathy, related to their awareness of the death of the specimens. As one child described, "I kind [of] feel sorry for them, because they all dead." More female than male participants in this research showed this kind of attitude, and participants who showed this attitude tended to be more aware of the specimens' characteristics instead of just focusing on the animals of the specimen. These findings are consistent with Tunnicliffe's (1996) observation on differences in conversations between boys and girls while looking at dioramas in natural history museums.

EDUCATIONAL IMPLICATIONS

The unique characteristics of the specimens; they are animals, but dead animals; they may be posed as alive but are not alive; they have fake eyes but the bodies are real, make the specimens both a vivid mediator for interpreting the knowledge of live animals and reinforcing science process skills. The educational potential of specimens as interpretive tools can be better met with a more rigorous selection of specimens using criteria such as aesthetic appeal, novel appearance and specimens that have the capacity to elicit an emotionally affective response. When educators are selecting specimens for a *touch table* they should not only consider the animal species but the characteristics of the specimen and how those characteristics may create opportunities to reinforce different attitudes towards animals. Special attention should be made towards how children respond to novel characteristics such as damage to the specimen and visual signs of the specimen preparation process.

The study also provides indications for future research into the use of specimens to better support conservation education. Of particular note was the apparent lack of ecological attitudes shared by participants. Further research into what characteristics of specimens help educators make stronger connections to conservation issues as well as whether the types of species grouped together are more likely to elicit ecologistic attitudes would be well worth pursuing.

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