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Studying Dinosaur Learning on an Island of Expertise

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In this chapter we will describe some preliminary findings about the ways that *islands of expertise* influence family visits to a museum. We will briefly outline some of the key theoretical motivations for this work as well as some of the specific challenges associated with conducting research in museum settings. Video recording family interactions provides researchers with unique access to the kinds of experiences that collectively shape the everyday cognitive ecology of childhood. Through a selected set of example transcripts, we will illustrate how video allows us to capture the rich character and texture of parent-child communication and begin to understand the ways that it shapes informal learning.

Children's experience of the world around them is often filtered through a lens of curiosity and wonder. Everything from rainbows to railroad crossings can capture the interest of a child and create an opportunity for informal learning. In the context of ordinary activities, children begin to practice observation and inquiry skills that develop into the fundamental components of scientific thinking. Children's attitudes and beliefs about science and scientific thinking seem to be influenced by early experiences in informal settings with parents and peers. Long before encountering their first formal science lessons, children are actively engaged in gathering information about topics, artifacts, and processes that spark their interest and imagination. Embedded in these experiences are the seeds of intuitive scientific inquiry.

Overtime, the accumulation of these experiences creates an intellectual common ground that can lay the foundation for the development of an island of expertise. The concept of islands of expertise is one way to describe the ways in which young children's nascent scientific thinking is supported and encouraged in the context of everyday family activity. Crowley and Jacobs (2002), define islands of expertise as the developmental process that occurs when young children become intensely interested in and knowledgeable about a particular subject, like dinosaurs, trains or animals. A typical island develops through an accumulation of everyday family activities, and over time becomes the focus of family conversations, the theme of bedtime stories, as well as the motivation to visit particular museums and zoos. Unlike the process of acquiring general knowledge or absorbing information from school, an island of expertise emerges through the active pursuit and co-construction of knowledge between parents or caregivers and children. As an island expands, it can support young children as they develop a sense of identity as individuals who possess a sophisticated understanding of one topic area. Initially, children who develop islands of expertise must be personally interested and motivated to learn more about a particular topic.

However, once children have a well established and socially recognized island of expertise, their "expert" status provides external motivation to learn more, integrate new knowledge with prior knowledge and explicitly demonstrate that knowledge whenever possible. As a result of this convergence of motivation and parental support, an island of expertise may provide an intellectual space that facilitates the development of higher level reasoning in that area as well as more generalized learning strategies and social skills. Only by directly engaging parents and children in the contexts where they are co-constructing their everyday cognitive ecology can we determine how islands of expertise may function as guideposts for future development.

Typically, young children are interested in a wide range of topics, from dinosaurs and trains to Harry Potter and Pokemon. Parents report that these intense interests often begin as early as 18 months and continue throughout pre-school and Kindergarten. Classic research by Chi & Koeske (1983) demonstrated that a 5-year-old child is capable of developing an extensive knowledge base that can be described as a network representation of the declarative domain of dinosaurs before entering Kindergarten. Following this case study, Chi, Hutchinson & Robin (1989) illustrated the structure of a declarative domain of knowledge and evaluated the impact of knowledge structure on how that knowledge is used in complex reasoning. More recently, Johnson & Eilers (1998) conducted an investigation to determine if domain specific knowledge and level of development had an impact on subordinate level category formation. Taken together this research suggests that young children can develop relatively sophisticated understandings of topics that they find interesting.

In this chapter we will discuss our current research on dinosaur islands of expertise. From the early planning stages to the data collection to the preliminary analysis, we will describe the process of developing a new approach to gain access to moments of parent-child interactions that may contribute to the development of islands of expertise. In the course of an average ten-minute visit to Dinosaur Hall, parents and children engage in constant negotiations of the exhibit space as they verbally and non-verbally communicate their interests and ideas. The use of video recording in these settings allows us to capture and preserve some of the moments that contribute to the development of the everyday cognitive ecology of childhood.

Let's go see the Dinosaurs: Predicting the influence of prior knowledge on family interactions in Dinosaur Hall

When families visit the Carnegie Museum of Natural History in Pittsburgh, Pennsylvania one of the main attractions is Dinosaur Hall. Whether it's their 1st or 50th visit, parents and children come to Dinosaur Hall to share the experience of walking among the fossils of creatures that lived more than 160 million years ago. Before beginning our data collection we expected that, for children who have never seen, touched, or stood in the shadow of a real dinosaur fossil, a visit to Dinosaur Hall would most likely be dominated by a sense of awe, wonder, and maybe even disbelief. For these novice children and their parents we expect that a visit to Dinosaur Hall would support conversations about the obvious surface features of the fossils on display. (e.g. "look how long that one is, look at that big one, look at those teeth!") There may be some quizzing about popular dinosaurs like Tyrannosaurus Rex or Stegosaurus. But in general the impact of the visit and the learning that takes place would focus less on markers of domain knowledge (e.g. labeling, categorizing, explaining relationships, rehearsing prior knowledge or generating theories) and more on providing children and parents with explicit examples of "real" dinosaurs that may support later learning. In addition to verbal engagement in the hall, we expected that novice families would have a distinctly different pattern of movement through the hall when compared to experts. In general, parents would dictate the pacing, choose when to stop to discuss a dinosaur mount, and when to disengage and move on to the next dinosaur.

In contrast, for expert children, their visit may still include elements of awe and wonder, however, this will not be the primary focus of the experience. Instead, for these children and their parents we expected that a visit to Dinosaur Hall will be filled with markers of domain

content knowledge. In addition, the shared experience will support conversations that explicitly rehearse existing knowledge about the fossils on display, in the form of reciprocal questions/answers and opportunistic noticing of ways to integrate the information presented in the exhibit with prior examples of co-constructed dinosaur knowledge. (e.g. There's T-rex. He's my favorite because he is called the king of dinosaurs and he was a great hunter. He even hunted dinosaurs with strong defenses like Triceratops) There may be some quizzing about favorite dinosaurs, however, unlike novices we expect that expert children will demonstrate both surface and deeper content knowledge. While we expect to see more traditional markers of domain content knowledge with experts (e.g. labeling, categorizing, explaining relationships, rehearsing prior knowledge or generating theories) the strongest impact of the visit may be as an opportunity to reinforce how the real dinosaur fossils relate to their prior dinosaur knowledge. In addition to high levels of verbal engagement in expert families, we also expected that the interests and knowledge of expert children would more directly influence the movement through the hall, either with parents navigating the visit around their children's favorite dinosaurs or with the child leading the parent to their favorites.

Data Collection in the Carnegie Museum of Natural History

Before beginning data collection in a museum setting like the Carnegie Museum of Natural History, it is critical that the research team develops a professional relationship with the museum. Unlike a more traditional laboratory study in which there is a designated space that can be reserved for the administration of tests, clinical interviews or parent-child observations, in-vivo museum research requires that the data collection take place on the museum floor. In many cases, the presence of a research team in the museum will have an impact on visitors, regardless of whether or not they choose to participate in the study. For a museum, the quality of a visitor's experience is one of their highest priorities and allowing a research team to alter the flow of a normal visit is a serious consideration. In our case, the year prior to our data collection, we had an opportunity to work closely with the museum's education department on a formative evaluation of a pilot distance-learning program on biodiversity. Through that collaboration we developed a working relationship with the members of the department and had the opportunity to learn about their practices. When it came time to more formally propose our research plan for a parent-child study of museum learning, the director of the department of education was very encouraging. She was supportive of the idea of videotaping families as they visited Dinosaur Hall, interviewing children to determine their level of dinosaur knowledge, and asking parents to complete a questionnaire regarding the families' interest and knowledge about dinosaurs. With her permission we were given access to Dinosaur Hall. But before we could begin piloting we had to resolve one last administrative detail: Informed Consent

It is important to us that families know they are participating in the study while they visit the museum. Our typical procedure for these studies is to greet visitors at the museum, give a very short introduction to the study, and obtain verbal consent from both parents and, if they are old enough to talk, children. Families who express an interest in participating are then walked through the written consent form and, if they agree with the form, asked to give written consent to participate (*Crowley, K., Callanan, M. A. et al., 2001*). Some studies of museum visits use an implied consent procedure where they post a sign telling visitors they may be recorded as they visit the museum. For museum-based researchers, such a procedure is possible and sometimes is

the best way to collect data. At the Exploratorium, for example, Joshua Gutwill and Sue Allen have been systematically developing the best procedure for placing implied consent signs so that the majority of visitors are made aware that they might be videotaped while at a particular exhibit and so could choose to participate or not.

However, we work at a university and are required to follow the human subjects research procedures outlined by the university's institutional review board (IRB). In the late 1990's, we were able to obtain IRB approval for a consent procedure that involved parents signing a half-page letter. However, a few high profile cases from the medical research world have since led the University of Pittsburgh IRB to a default position of treating most research submissions as if they were high-risk medical research. The standard sample informed consent form that can be downloaded from the Pitt IRB web site is an eight-page document organized into eighteen question and answer sections filled with information relevant to the study as well as disclaimers designed to put the university's legal department at ease. For studies using sophomore psychology students or patients at the hospital, a long, complicated consent letter probably does not appreciably depress rates of participation.

But how does the same document read to a parent visiting a museum? First of all, that question is probably moot because we do not think most parents would read through eight pages of dense text while their children were begging to go see the dinosaurs. Second of all, even if they did get all the way to, for example, page 3, section 4, we think they might ask themselves: Why would this nice lady who is interested in what my child knows about dinosaurs feel that it is necessary to inform me that in the case of serious injury resulting from participation in this research, emergency medical treatment will be provided by the University of Pittsburgh Medical Center?

Because we were going to interview and videotape children under the age of 18, we knew we would need a signed parental consent form that had been approved by the IRB—hopefully something less than eight pages that would give parents the necessary information to determine whether they wanted to participate, but that would do so in a straightforward way that would fit into the short window we would have to pitch our study to families as they headed for the dinosaurs.

Our opening bid in the negotiation with the IRB was to propose a one-page letter describing the study, assuring parents that the data would be confidential, that they could withdraw at any time, that they would not be compensated, and providing our contact information if they had any questions once the study was complete. That didn't work. The IRB required that we insert specific language around each of these issues. When we followed their instructions we ended up with a three-page letter. We knew we would not get away with a single page, but we felt three was still too long. We fiddled with the font size and margins—still three pages. So we went back and explained more specifically to the IRB about the goals of our study and why a long consent letter would most likely make it impossible to collect this kind of data. We also argued that a long letter would probably not serve our participants well in terms of informed consent because no one would have the time or attention, in the midst of a museum visit, to read a long letter. They understood and worked with us to get the three pages down to two. With our abridged version of the informed consent form, we set out to videotape some family interactions.

In our prior studies at the local children’s museum, we were used to consent rates that typically exceeded 90%. Confident that our typical recruitment strategy would work, we were shocked after the first day of pilot data collection, when 15 out of 20 families brushed us off before we had even had the chance to get through the first part of our IRB-approved speech. Even worse, out of the 5 families who agreed to participate, 4 dropped out of the study after the pretest when we announced that it was time for them to put on the wireless microphones and visit Dinosaur Hall. We had started out planning to collect 40 families in four to five days of work. Now we were looking at 40 days of data collection and an endless pageant of rejection. It was a bad day.

The next weekend, we returned to the Dinosaur Hall with a new plan. Because most of the families who began the study opted out of participation when it was time to wear a microphone and visit Dinosaur Hall, we decided to move the visitation phase to the beginning of the session. We anticipated that this adjustment would improve the consent rate because we would be more in synch with the typical visit agenda. Museum researchers often comment on the importance of the flow of a visit. While individual interests often dictate the flow of a museum visit, environmental factors like the physical division of space and the lighting can also have a significant impact on visitor behavior (Falk & Dierking 2000). Considering that Dinosaur Hall is the signature experience of visiting the Carnegie museums-it is almost always the first place that families visit once they enter the museum. (In fact, lots of locals call the Carnegie the “Dinosaur Museum.”) Approaching families with young children and asking them to postpone their visit to the dinosaurs within 50 feet of their goal in order to participate in our study may have made them reluctant to agree. It was clear that in order for this recruitment to succeed, it was critical that the process would be perceived as a quick interruption of the family’s visit plan as opposed to a total disruption of their visit experience.

With this in mind, we returned to the museum and began to recruit. The first family was a father and 6-year-old boy. It was 10:30 A.M. on a Saturday in early November, 2003—the museum had just opened. This was the family’s first visit to the Carnegie. They were from out of town and had come to the museum specifically to see the dinosaurs. The experimenter approached them and said:

“Hi, my name is Sasha. I’m a volunteer at the Carnegie and a student from the University of Pittsburgh. Today we’re asking families to visit Dinosaur Hall and wear a wireless microphone. We’d like to tag along and see the kinds of things you talk about when you visit Dinosaur Hall. After you take about a 10-minute visit come back out and check in with us and we have a quick question-and-answer game at the table here. Do you think you might want to do that? You would? Great!”

It worked for the first family. And it kept working all day. We collected eleven complete sessions and got only four refusals. No families withdrew from the study after beginning. The next day, a Sunday, we collected eight complete family visits and got six refusals. Most of the six refusals were families who had scheduled a tour of a new traveling exhibit and were simply passing through Dinosaur Hall to get to the tour on time. This acceptance/rejection ratio was much closer to our expectations and at the conclusion of this round of data collection our average consent rate was approximately 60% with most refusals accounted for by previously scheduled tours of the traveling exhibit.

Characterizing Family Visits: Tour guides and Tourists

With so much to see in Dinosaur Hall, families often make multiple passes by the dinosaur mounts before they are satisfied that they have completed their visit. Visiting Dinosaur Hall is an immersive experience that supports complex demonstrations of verbal and non-verbal communication between parents and children. The experience of Dinosaur Hall is dominated by the size and presence of a dinosaur bones towering over the visitors. Because of this physical relationship of the visitor to the hall, there is an implicit demand to constantly compare yourself to the creatures around you. Some parents and children do this verbally, making statements like, “I think one of those leg bones is bigger than you!” Some parent’s lift their children up so that they can get a closer look, only to be immediately asked to be put down with refrains of, “Too, close, too, close!” Using video to capture the words, gestures, and facial expressions of families as they visited the hall provided us with a multi-modal record of the experience that we are just beginning to analyze.

However, after the first day of successful data collection there were clear distinctions in the ways that expert and novice families chose to navigate their passage among the dinosaurs. In addition to differences in their physical course and selected stopping points, expert and novice families appear to negotiate leadership of the visit experience in different ways. When there is an apparent imbalance in the amount of knowledge between the parent and the child, the more expert of the two typically takes the lead and controls the pacing and progress through the hall. In the role of “tour guide” either the parent or child highlights things they find most interesting and glosses over other information. For the non-expert in these groups, they assume the role of the “tourist”, politely listening, following along and asking questions from time to time. In family groups where both parties express a situational interest, but neither parent nor child immediately adopts the expert/ tour guide role, leadership of the visit is exchanged as parents and or children are drawn to things that capture their attention. Preliminary analysis of the visit data suggests that distinct patterns of interaction emerge depending on the amount of prior dinosaur knowledge children and parents bring with them to the museum. In each of the following interaction excerpts there are clear verbal and non-verbal cues of interest, knowledge, and visit agenda. We have selected some examples that more clearly illustrate the characteristics of family visits to Dinosaur Hall. In the first two interactions, children are featured in the novice role. While in the second two interactions, children are featured in the expert role.

Shared Wonder (Parent Novice-Child Novice)

This kind of interaction focuses less on the information in the hall and more on the experience of being in the hall. Families in which both parent and child demonstrate minimal dinosaur knowledge and basic levels of situational interest seem to move through Dinosaur Hall relatively quickly, allowing minimal time for exploration and discussion of the objects around them. During this visit, mother and daughter are almost constantly in motion. While they are walking slowly, neither expresses the intention, verbal or non-verbal, to pause and gather information about the things they are seeing. While mother and daughter frequently look together at the dinosaur mounts, there is a very short mutual gaze interval, often less than 5 seconds. On the parent questionnaire this mother rated her daughter’s interest in dinosaurs as and her knowledge

as minimal. This mother self-reported only a minimal level of interest and knowledge about dinosaurs.

Mother & Girl, 5 years old

G: Ooh, mama, look

M: What?

G: Look at its long tail. I want to go to the end [walks down the length of the Apatosaurus mount, mom slowly follows] mama, come to the end of...

M: Wow, that's a long tail [they turn away from the tail and walk over to the foot of the T-Rex mount]

G: Look [points to the feet of the T-Rex]

M: [points up] You know what this is, look up

G: T-rex! T-rex, t-rex, aww

M: Look at how big a t-rex was

G: I want to touch it

M: Wow

G: I want to touch it, the end of the tail

M: Oh, I don't think you can touch it baby

G: Can we go to the end?

M: Yes, we can go to the end [together they walk around to the left of the T-rex, with mother leading]

G: Look, look, aww, whoa, whoa whoa, look at, mama stop [mom pauses and looks quietly] Hi Triceratops. [mom walks away and girl follows behind, they stop at the back to the T-rex]

M: Let's see, yup there's his tail. See it, there. [points to the end of the T-rex tail while they stand behind the mount]

G: Whoa.

M: Where do you want to go next? Look, baby, look up. [Daughter looks around] No, this way.

G: A Pterodactyl [Points up to the corner where the Pteranodon is perched and then looks past it to the wall] Mama, a meat eater!

M: Huh? Hey what's that over there? [points across the hall] Over on the wall. There's a great turtle on the wall. See it?

G; Where? [Tries to look across the hall through the other displays]

M: Right there.

G: Where? [walk together around the back of the t-rex again, mom in the lead] Other dinosaurs! Oh, Turtle, turtle, turtle (runs up to the case)

M: Big turtle

In this interaction, it seemed as though the mother's goal was to encourage her daughter's developing interest in dinosaurs by showing her the real things and reinforcing the sense of wonder that is often associated with the size and stature of dinosaur fossils. During this visit, neither the mother nor the daughter seemed to focus on gathering new information. While the daughter spontaneously labeled several dinosaurs during her visit, the mother did not explicitly encourage labeling or correct her daughter when she incorrectly labeled the pterodactyl. Instead, this visit seemed to merely skim the surface of Dinosaur Hall without deeply engaging with any of the available information beyond the visual experience.

Parent guided exploration (Parent General Knowledge-Child Novice)

This interaction features parents in the role of teachers and interpreters of the available information in the hall. When parents primarily dictate the movement from one mount to the next, they pose questions, make comments, answer questions, and refer to the signs when they are unsure of an answer. Children occasionally indicate special interest in objects that influence the movement through the hall, but for the most part they are following along as parents do the work of highlighting and interpreting information that they find interesting. Visits like these are characterized by frequent pauses to examine or discuss the things they are seeing. On the parent questionnaire this father rated his daughter's interest and knowledge in dinosaurs as minimal. This father self-reported that he was had a moderate level of interest and knowledge about dinosaurs. The mother in this interaction did not complete a survey, so her self-rating of dinosaur interest and knowledge is unknown.

Mother & Father and 6-year-old girl

[As they enter the hall they are all holding hands, but as the father takes the lead on the questions, mom drops back a little. Every time he asks a question he leans down to his daughter's level and they slow down enough to comfortably discuss the answer. If the daughter does not know, they move on fairly quickly.

F: What's this one called?

G: I don't know

F: That's a Stegosaurus.

G: Oh, yeah, I was drawing those the other day.

F: How about this one?

D: Don't know

F: What's this one called?

G: Tyrannosaurus Rex [She smiles at her father and hops with enthusiasm. He smiles back]

F: Very good. Hey look at that big turtle on the wall. [The whole family continues at a slow stroll along the Triassic wall of marine life]

G: Wow. Hey look at this picture. What kind of dinosaur is the T-rex eating? [The whole family stands under the mural of a T-Rex eating a Triceratops. In the background there are some other T-Rex who seem to be hunting a herd of Triceratops. The whole family studies the picture in silence]

M: That's a Triceratops.

G: Oh, poor Triceratops. [mom reads the sign and leans down to talk with her daughter gesturing towards the mural and the label she just read]

M: Do you think T-rex killed it (Triceratops) or do you think he just found it and started eating?

G: Maybe he just found it cause he's just standing there. [points to the picture]

F:[leans down to daughter's level again and points to the T-rex in the background] Maybe he's protecting his food so no one else comes to eat it. [daughter shrugs while her mother studies the case in front of the picture. In a moment the daughter has her face close to the glass and is looking at a fish fossil that her mother is studying]

M:[pointing to the fossilized fish she asks] Did we see something like this at the zoo?

G: Umm, no. . . But I think it looks like a stingray to me.

M: Very good, I think that's right. [the family moves off together and returns to investigating the dinosaur mounts in the center of the hall]

In this interaction, the goal of the visit seems to be oriented towards using the museum as a place to gather and learn facts about the dinosaurs and other prehistoric creatures featured in Dinosaur Hall. While these parents seem to be attentive to the things that their daughter finds interesting and expresses some knowledge about, in general their visit is characterized by frequent

exchanges of short, incomplete explanations that provide enough information to answer a specific question without going into too much detail.

Expert Child-Novice Parent

In contrast, expert family interactions seem to be focused on rehearsing the child's knowledge while the parent (and the camera) act as an informed audience. The visit to the hall is like a stage on which the child can perform the role of dinosaur expert and be recognized as a child that knows a lot about dinosaurs. As this child makes his way through the hall he allows no opportunity for discussion of his recitation of dinosaur facts. At each mount he recites what he knows and then moves on, only waiting for his mother to join him before he starts the next lecture. On the parent questionnaire this mother rated her son's interest in and knowledge about dinosaurs as high (7 on a 7 point scale). The mother self-reported that she was only moderately interested and knowledgeable about dinosaurs giving herself a 3 in response to both questions.

Mother and 7-year-old Boy

[walk together into the hall, mom has her arm around his shoulders. As they get to the first dinosaur mount, boy takes a step away and begins to recite what he knows about Stegosaurus. Mom takes a step back and listens.]

B-That is a Stegosaurus. Its spines are used to control its body heat and its tail with the spikes is actually what it attacks with. It's over 30-feet-long, well it can be over 30 feet. [finishes explaining and takes mom's hand, turns around and guides her over to the next dinosaur he wants to talk about]

M-Mmhmm.

B-And this one is an Allosaurus. Allosaurus is better than Tyrannosaurus because he can run faster and he is more intelligent. He is umm, a carnivore and he eats other dinosaurs. He can be over 20 ft long and he is very big.

M: Wow. [under her breath. Son glances right and finds his next target. He drops mom's hand again and starts walking to the next dinosaur he intends to talk about]

B: That is a Diplodocus. Well, at least I think it is. I'll just check. [walks over and checks the sign] Yup, Diplodocus. This is a Diplodocus. [mom nods and points tracing his length in the air] He's very big. It is one of the biggest dinosaurs. Only, Seismosaurus is the biggest dinosaur, but that's really big. It is a plant eater and it can grow over 70 feet long. [continues to recite, standing a pace in front of his mother as she nods and smiles and pats him on the shoulder] and umm, it's not like Apatosaurus who can lift its feet up very good and tramp its enemies. [glances back at Apatosaurus for one moment, does a double take and then heads over to it. Mom follows]

B: This is Apatosaurus. [crosses the hall to stand next to it and points] Apatosaurus could even be bigger than this sometimes and he can trample a Tyrannosaurus Rex. And his ribs are bigger than Diplodocus'. If you look at his skeleton it looks like a couple of people could fit under its ribs. [Glances left and starts walking, slows down to make sure that his mother has followed] And that, that is T-rex. [Mom looks up and then smiles down at her son] Remember, I talked about him when we were at the Allosaurus. [Mom kneels down next to him and looks up at the T-rex from his height] He is the one with, well, he's not very intelligent and his ribs are very small.

M: mmmhmm

B: He doesn't run very fast, so he actually waits for his meals to come close sometimes and I think maybe only like one kid could fit in his ribs.

M: [Listens, nods and smiles]

B: Ok, that's it for now.

M: That's all? Ok.

For this pair there seemed to be an agreement that this visit to Dinosaur Hall was a time for rehearsing knowledge. While many expert visits to Dinosaur Hall have performance elements where children display their knowledge with the encouragement of their parents, this pair was by far the most extreme example. However, this interaction is especially interesting when compared with other knowledgeable child-parent groups, like the next interaction. While the mother is virtually silent in the previous interaction, in the next example, the mother actively works to enhance her son's factual recitation with additional information. In this process, she encourages him to go beyond what he already knows and think about a few new facts about dinosaurs.

Expert Child-High Knowledge Parent

This mother and son pair had a very detailed discussion and interaction in Dinosaur Hall. Of our sample to date, they are the most frequent visitors to Dinosaur Hall that we have had the opportunity to interview. They come to the museum together at least once a week, usually on Saturdays. They never come to the museum without spending some time in Dinosaur Hall. On the parent questionnaire, mom rated her son's knowledge about dinosaurs as a 6 out of 7 and his interest as a 7. She rates her own knowledge and interest as a 6 out of 7. In this pair there is a constant exchange of leadership roles in terms of providing information, however, the son dictates the physical movement through the space. The son seemed interested in rehearsing his knowledge about dinosaurs, however, the mother frequently asks questions, challenges his statements, and asks how he knows what he recites, encouraging him to make references to prior knowledge. After stopping and discussing a few plant eating dinosaurs along the wall, the pair make their way to the foot of the T-Rex and the son begins to rehearse what he knows about the T-rex.

Mother and 5 year old son

B: T-rex was the biggest most fearsome meat eater in the world and it could catch up with a Triceratops with its running and its sight was good and its hearing, it could hear a dinosaur very far away. And it was carnivorous.

M: Ok, and what does that mean, carnivorous?

B: Umm, that means that it's a meat eater

M: That's right, that means he's a meat eater. [mother smiles and kneels down next to her son to examine the sign in front of T-rex more carefully. They both lean over the cushions and read through the information together]

B: [Son glances back up at the mount and continues his thought] And it would break down and bones and broken flesh

M: Right. Now look what it says here [points to top of the sign and son leans over for a closer look] Here it says Triassic, Jurassic, Cretaceous and it says that it lived at the very end of the Cretaceous. That means that it must have been around when the dinosaurs went extinct.

B: Yes, it was.

M: And it was found in the United States, it was found in Montana.

B: And it was the toughest meat eater to rule the planet. Its fingers were ideal to claw onto stuff and its jaws could rip off huge chunks of meat.

M: Hmm, did you hear that when they did the show [reference to light show and story presentation in dinosaur hall]?

B: Yeah. And its skull...

M: Yes, do you know how long it (T-Rex) was?

B: Examines sign for a minute. Yeah, up to 50 feet!

M: That's right, you got it! [points to the place on the sign that talks about measurements]

B: And 15.2 meters. And it would weigh a lot.

M: And that's who collected it. Barnum Brown.

B: In 1902 to 1903.

M: [gestures to the sign again and then looks at her son] Well, what year is it now?

B: 2003.

M: So that means that that was 100 years ago. It was discovered 100 years ago.

B: So that isn't a very long time.

M: No, but it's been extinct for a very long time, right?

B: Yup. [both mother and son look away from the sign and up at T-Rex from the son's level in a shared moment of silence. Then the son moves away and heads towards the next dinosaur of interest. He stops next to one of the large sauropods and points as he asks his mother] Is that Dippy?

M: Yes, that is Dippy.

B: Dippy is my favorite buddy dinosaur and he has a sculpture outside. He was even the first dinosaur to be discovered.

M: Was it?

B: Yeah. Of the plant eaters. He's been my favorite for a long time.

M: Yeah, I like Dippy, too. He was a nice dinosaur. Do you want me to read any of this to you? [Kneels down with son to look at the information sign. Son glances at the sign and then back to his mom]

B: He lived in the Jurassic [points to the sign]

M: Exactly, so you can figure out how this works [indicates the time scale on the sign]

B: She was my favorite that lived at the end of the Jurassic period

M: Uhuh.

B: And that was my favorite time on land when dinosaurs were around

M: You know what? It says that Diplodocus was a close relative of Apatosaurus and that makes sense right?

B: Yes [mother and son take one final look together at Dippy and then son glances at Apatosaurus and seems to decide to skip that for now. Instead, he waits for mom to stand up and leads the way to the Allosaurus mount] Now Allosaurus, he's a lot like T-rex, a good hunting and stalking dinosaur. He could run fast, and he was strong.

M: Yes, it says his jaws were very strong and it held teeth that were sharp, sharp like a steak knife [She points to the sign]

B: Yes, and that means they were good for cutting meat

This pair stayed in Dinosaur Hall for almost a full 20 minutes and carefully discussed almost every dinosaur featured in the hall. Though the son seemed content to rehearse the things he knew about the dinosaurs as he visited them, his mother took each opportunity to direct his attention to additional sources of information and to challenge him to think more deeply about dinosaurs and how they were related to each other. Because of their familiarity with the space, and the features of the exhibit, this mother and son seemed to have a well-established visit schema and generally were in synch when engaging and disengaging in a discussion about a particular mount, regardless of who expressed the initial interest in that particular dinosaur.

Conclusions

In general, the emerging patterns of parent-child interaction are consistent with our expectations. Expert visits to Dinosaur Hall often include minimal expressions of awe and wonder. Instead, these children and their parents seem to view Dinosaur Hall as a place to exercise domain content knowledge including labeling, categorizing, explaining relationships, rehearsing prior knowledge and generating theories. A strong characteristic of the expert-visit is the desire to independently rehearse existing knowledge about the fossils on display, primarily in the form of a lecture style monologue. For some parents, typically those with less personal knowledge and interest in dinosaurs, they are willing to allow their child-experts to “show-off” their knowledge with little interruption. For others, they recognize and support their children’s interest and knowledge while more actively posing questions and providing additional information to further enhance their mutual understanding of dinosaurs. In addition to experts’ higher levels of verbal engagement, they also distinguish themselves from novices through their use of non-verbal communication to negotiate the exhibit space. Expert families seem to be more focused and purposeful than novice families as they move between mounts and exhibit cases. Especially for expert families who have visited this hall before, we see rehearsals of established visit schema in which parents and children move smoothly from location to location, with no need to call over, break away or abruptly change focus. Expert families who are new to the hall seem to demonstrate more abrupt transitions between foci of attention, however, there are still personally motivated goals attached to their movements through the hall and clear non-verbal allowances for the exchange of dinosaur information.

For the novice family, visiting Dinosaur Hall seems to be either an opportunity to share an information lean experience of awe or to begin to explore this area in terms of the obvious surface features of the fossils on display. In general the impact of the visit and the learning that takes place focuses less on markers of domain knowledge (e.g. labeling, categorizing, explaining relationships, rehearsing prior knowledge or generating theories) and more on providing children and parents with explicit examples of “real” dinosaurs that may support later learning. In addition to verbal engagement in the hall, novice families move through the exhibit space with less focus and usually without identifiable goals. Since parents typically dictate the pacing, their choices about when to stop and discuss a dinosaur mount and when to disengage and move on to the next dinosaur are usually related to their dinosaur interests and knowledge.

Children are constantly asking questions and engaging in basic science oriented conversations with their parents while watching T.V., reading books, or driving in the car. In the context of these everyday activities as well as trips to museums, zoos, and parks, children have the opportunity to practice reasoning and theory building with the guidance of their parents (Korpan, Bisanz, Bisanz & Boehme, 1997; Crowley & Jacobs, 2002; Crowley & Galco, 2001). As researchers interested in the cognitive ecology of childhood, our first step is always to figure out how to point our video cameras at informative moments of everyday activity across the different contexts where it occurs. In this chapter we have described some of what that first step has entailed. Our next set of questions will push us beyond consideration of informal activity to wonder about what the specific ways that islands of expertise might support subsequent advanced science learning—in classroom and informal settings.

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