

Learning Center Front-End Evaluation Report of Key Findings & Recommendations

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Audience research and planning for the mission-driven world.

4147 North Ravenswood Ave. #302
Chicago, Illinois 60613
773.388.9200 main
hello@sloverlinett.com
www.sloverlinett.com

Contents

Project Overview	2
Project Background & Objectives	
Methodology	
Strategic Recommendations for the Learning Center	5
Key Findings: In-Depth Interviews	
Elements of an ideal museum experience	10
Interacting with NMNH collections, scientists, and research work	34
Other opportunities to make science relevant	47
Additional considerations	52
Key Findings: Peer Review	
Peer institution profiles	55
Summary of key concepts	90
Appendix	94
In-Depth Interview Guide	

Project Overview

Background and Objectives
Methodology

Background and objectives

- The National Museum of Natural History (NMNH) is developing a Learning Center within the museum
 - The purpose of the Learning Center is to provide ways for NMNH’s audience to experience and pursue relevant and personal connections to natural history content
 - It is provisionally envisioned as a flexible space in which visitors can experience science in a more immediate and participatory way than elsewhere in the museum, especially through interactions with the museum’s collections, scientists, and research work
- NMNH’s Office of Education and Outreach engaged Slover Linett Strategies Inc. to conduct a front-end visitor evaluation to inform the development of the Learning Center
 - We designed a two-part evaluation plan to meet NMNH’s core objectives:

Part 1. In-Depth Interviews

Objectives:

1. Identify the elements of an ideal museum experience
2. Learn how visitors & non-visitors perceive NMNH’s scientists, collections, and research work and feel about interacting with them
3. Shed light on what (else) would make science more relevant & inspire learning

Part 2. Peer Best-Practices Review

Objective:

4. Identify models of successful innovation in informal learning, both within and beyond the science and museum sectors

Methodology

Part 1. In-Depth Interviews

- We conducted 53 in-depth interviews:
 - 46 **in-person** interviews with visiting parties at NMNH, the National Museum of American History, and on the National Mall
 - Respondents were recruited according to demographic and behavioral quotas
 - 7 **telephone** interviews with subscribers to NMNH's E-Newsletter
- Interviews included 135 people in total
 - On average, each interview lasted between 35–45 minutes
- Interviews included a projective “card sort” exercise in which respondents were shown 10–12 science- or nature-related images
 - Respondents ranked the cards from most to least appealing and discussed what they liked or disliked about each
- In-person interviews took place from October 8th–11th; telephone interviews took place from November 4th–6th

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National Museum of Natural History 4.

Part 2. Peer Best-Practices Review

- We selected 13 “peer” institutions who are engaged in innovative practices to reach their audience
 - Institutions were selected using a broad definition of the relevant landscape:
 1. NASA Jet Propulsion Lab’s Open House
 2. The Apple Retail Store
 3. Weston Family Innovation Centre at the Ontario Science Centre
 4. Oregon Museum of Science & Industry’s “Science Pub” Program
 5. Jamestown Settlement + Colonial Williamsburg
 6. The World Science Festival
 7. The Eden Project
 8. Corning Museum of Glass
 9. Darwin Centre
 10. Dinosaur Digs at the Indianapolis Children’s Museum
 11. Radiolab
 12. America’s Test Kitchen
 13. The Arena Spectacular
 - Institutions were identified through internal brainstorming, discussion with the NMNH team, and from institutions mentioned during the In-Depth Interviews

Strategic Recommendations for the Learning Center

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National Museum of Natural History 5.

Strategic Recommendations for the Learning Center

#1 Collections objects need to be integrated into an activity or process to be compelling

Being in the presence of NMNH's collections objects is important to most visitors, but interacting with collections objects may be a limited draw of the Learning Center. Visitors want to participate in a process: something that actively engages them and enables them to see change, transformation, and movement. Objects can be an important "tool" to use in such activities — they heighten the authenticity and sense of privilege afforded by the activity and make the activity itself more concrete.

#2 Interactions with NMNH's people in the Learning Center need to be personal, entertaining, and readily available

Most visitors have some perceptual barriers that make them ambivalent about interacting with scientists, whom they expect to be tough to communicate with on an informal, one-on-one basis. But they do place a high priority on opportunities to interact with the museum's experts, broadly defined. The Learning Center should be a "high touch" experience: abundantly staffed with knowledgeable, charismatic people (whether scientists or non-scientists) who can provide guidance, answer questions, convey their passion for science, tell vivid stories, and engage visitors in informal conversation.

#3 The space itself should be memorable, with a distinctive personality

The environment and atmosphere of the Learning Center should be unique and clearly distinct from the rest of the museum. It should create a strong "sense of place" that becomes part of visitors' memories of the experience and of the stories they later share with others. It should not feel like a classroom, nor should it be appealing only to children.

Strategic Recommendations for the Learning Center

#4 Accommodate a wide range of preferences in the Learning Center — especially with respect to passive and active participation

A visitor base as large as NMNH's encompasses a wide variety of learning styles, knowledge levels, interests, and exhibit-style or activity-style preferences. The Learning Center should offer a number of different activities, exhibits, and experiences from which visitors can choose according to their needs. For example, an active mode of engagement should predominate, but be sure to incorporate prominent spaces and experiences for a more observational, relaxing kind of participation. Such variety will boost the Learning Center's appeal to large, intergenerational visiting parties who are trying to balance multiple needs within a single experience.

#5 Provide assistance and tools to help visitors "assemble" their own Learning Center experience

When offered a wide variety of things to do, visitors need guidance in understanding what the activities are and how to choose the ones that will best serve their interests. A "host" or "conierge" model seems well-suited to the Learning Center, in that it can provide a "high touch" way of helping visitors customize an experience for maximum personal meaning. It will also help set the tone that the Learning Center is a friendly, fun space where pursuing your own interests is encouraged.

#6 Integrate the Learning Center experience with the rest of the museum

Activities in the Learning Center should point visitors to places in the rest of the museum where they can learn more about the subject at hand. Likewise, exhibits around the museum should point to the Learning Center as an opportunity for closer, more hands-on experiences with the object. The Learning Center can also be integrated with the rest of the museum in another sense: by making the museum's back-of-house world and work transparent to visitors.

Strategic Recommendations for the Learning Center

#7 Help visitors take the Learning Center home with them

Provide visitors with a tangible take-away or a follow-up activity they can do from home, to help them connect their Learning Center experience to their everyday lives. Souvenirs (especially photos) give physical or visual form to visitors' memories of the experience and can help them "tell the story" of their visit to family and friends back home. Guiding them to opportunities for further exploration outside of the Learning Center (for instance, at their local natural history museum or science center) would ensure that the learning process doesn't end when they exit the Learning Center. The Learning Center's online portal presents an ideal opportunity to connect the in-person experience with further at-home exploration; consider providing special access content on an "alumni" site or content that's customized to what the visitor did at the Learning Center.

#8 Consider making adults a key target audience for the Learning Center

Adults' learning needs aren't always the priority in typical science museum exhibits. Many of the hands-on participatory experiences at museums — even those designed for intergenerational participation — are perceived as targeted toward a child's skill and knowledge level. This suggests a real opportunity for the Learning Center to provide activities that stimulate and challenge adult visitors and don't feel like "kid stuff." (This might include activities that adults and children can engage in together, but with a role for the adult to play in helping their child interpret the activity.)

#9 Personality matters; think strategically about the tone of the Learning Center, especially with respect to humor

Many of the successful experiences we studied use humor to convey science concepts accessibly while still keeping it smart. Visitors also reported enjoying interactions that were informal and involved humor. By keeping its tone light and its personality witty, the Learning Center will appeal to a wider range of museumgoers, including younger visitors.

Strategic Recommendations for the Learning Center

#10 Build in ongoing evaluation, formally and informally

Making science relevant to visitors starts with understanding — and embracing — where visitors are. What interests do they walk in the door with? How are they using the exhibits or activities (which might include ways that were not intended by the museum)? What are they wondering about? In addition to this front-end study, continuous evaluation using both formal methods and informal observation and dialogue with visitors, will be necessary to help NMNH meet visitors where they are and keep the Learning Center's content relevant as the public's interests and expectations evolve.

Key Findings: In-depth Visitor Interviews

Elements of an ideal museum experience

Interacting with NMNH collections, scientists, and research work

Other opportunities to make science relevant

Additional considerations

Elements of an ideal museum experience: What makes a museum visit interesting, memorable, engaging, or inspiring?

- We identified **six key elements** that lead visitors to view a museum experience as particularly interesting, memorable, engaging, or inspiring
 - Incorporating these elements into the Learning Center may help ensure that the experience it provides stands out among other informal learning options
 - The relative desirability of these elements didn't vary much among the different demographic and behavioral sub-groups in our sample

→ Age of the respondent was the one demographic characteristic that did seem to influence attitudes in a substantial way: older respondents tend to find highly participatory experiences somewhat less appealing



- It's worth noting that most NMNH visitors we spoke to have participated in many engaging museum experiences that successfully tapped into their desire for one or more of these elements; the sum of those experiences is the yardstick by which they evaluate their experience at NMNH — and will evaluate the Learning Center

Element #1: Relevance

- First and foremost, the experiences that stand out in visitors' minds are those that enable them to relate their experience in the museum to their lives outside the museum
- Visitors bring their personal curiosities into the museum, and these relate to their professional, home, or family lives
 - They are then drawn to exhibits that promise some connection to those interests
 - A pilot we spoke with recounted a special trip he made to NMNH when he was in D.C. on business: *"You always hear about the gas they put in planes to make the air different. I became curious about it, so I came to the museum and found the rock that is connected with the chemical compound that makes the air breathable. Now I know why I can breathe while I'm flying."* (Onsite, NMNH)
- Museum experiences that enable visitors to learn about themselves are particularly well-suited to forging this connection with visitors' personal worlds
 - Health and the body are top priorities for many visitors, and science-related content is perceived as more relevant when it is connected to their own health
 - This seems to be particularly true for those who have a heightened awareness of their health, such as those who have experienced a disease
 - One visitor who had recently undergone surgery felt that the museum could offer her insight into *"what the doctor was thinking when he made those decisions"* (insight that the doctor himself hadn't given her) (Onsite, NMAAH)
 - Science activities that require visitors to bodily participate as "test subjects" are especially appealing because they provide an opportunity to physically connect with the scientific phenomena in question
 - In our image sorting activity, visitors reacted enthusiastically to the image at right, which shows a young person participating in an experiment →



Element #1: Relevance (cont.)

- Topics of current popular interest also tap into visitors' need to connect museum content to their daily lives
 - Subjects that are related to high-priority national topics attract attention even if visitors have no previous knowledge of those subjects
 - *"We should be studying the bacteria 'du jour'. That would relate to all of us."* (Phone interview)
 - *"From an exhibit about feathers, I learned more about the plane crash in the Hudson a few months ago."* (Phone interview)
 - Topical and timely content also helps satisfy visitors' desire to be well-informed
- By providing visitors access to the context (social, political, historical) of an object or exhibit, museums give visitors more opportunities to make personal connections to the material
 - Knowing the context can make something seem more relevant than it would be if it were treated abstractly or in isolation
 - *"I want to be able to know the context, so I know where it is in relation to me and things I know about."* (Onsite, NMAAH)
 - *"When I can see comparisons between things I've seen before and exhibit things, I get a more holistic picture."* (On site, NMAAH)
 - Visitors like exhibits that provide information about historical context — the social, geological, or natural events that occurred simultaneous to or in conjunction with the event or object under study
 - *"If I'm doing an activity with something, I want the history of it too."* (Phone interview)

Element #1: Relevance (cont.)

- Personal relevance is essential to enhancing visitors' interest in and capacity for learning
 - Being able to relate new information or objects to their own prior experiences gives visitors an entry point into new ideas, so they can make sense of them
 - They relish the “a-ha” moment when they encounter something new that bears upon their world
 - “There’s a mystery in the moment of discovery, which is very interesting.” (Onsite, NMAH)
 - The process of discovery gives visitors a sense of having accomplished something in the museum, and it sparks ideas and opportunities for action that stick with them after the visit
 - “The [discovery] experience spawns introspection after the visit.” (Phone interview)
 - “[The a-ha moment] is like a starting point for [us] to do more exploration on our own.” (Onsite, NMNH)
 - For many visitors, that further exploration is central to what makes a museum experience satisfying
 - “A museum visit is more than just an ephemeral experience. I want to take it beyond my visit – this is what makes a museum experience transformative.” (Phone interview)
 - Personally engaging museum experiences can also deepen and reinvigorate visitors’ interests in particular subject matter
 - “It intensified my thinking about a subject I was already concerned about—it brought it to life for me.” (Phone interview)
- Even though visitors say they enjoy NMNH’s subject matter, they sometimes have trouble finding content that feels personally relevant to them
 - They don’t often see objects or ideas that they encounter in their daily lives
 - This hampers their ability to make connections between new information and their everyday worlds

Element #1: Relevance (cont.)

Insights for the Learning Center:

- The Learning Center could be home to a plethora of activities, objects, and experiences that connect scientific phenomena to visitors’ daily lives, such as:
 - An ECG monitor that visitors could use to read their own heart levels
 - Enable them to learn about their own bodies and health
 - Watch something “happen” during the test
 - Opportunities to bring samples from home into the museum to test for bacteria
 - This would enable visitors to learn about an area of their life that is very close to them
 - Activities could be linked to other exhibits on the role of bacteria
 - DNA analyses using visitors’ own hair
 - This would allow participants to learn more about themselves and perhaps their family histories (genealogy is a popular area of “amateur” research right now and another potential source of relevance)

Element #2: Customization

- Visitors place value on museum experiences that allow them to tailor experiences to suit their personalities, interests, or moods
 - Visitors select among exhibits (and even within a given exhibit) by focusing on topics they are already interested in or curious about, so some personalization is built into the museum visit
 - It's a process of mixing and matching their own priorities with what the museum offers
 - They also seek out the kinds of exhibit experiences that they find most appealing
 - Some prefer more traditional exhibit approaches, while others seek out newer and more interactive styles
 - "Interactives are fine, but I want to be able to read things too." (Phone interview)
- Allowing some degree of flexibility in how visitors use the exhibits is important to providing the desired level of customization
 - Some visitors want to use the exhibit (and more broadly the museum visit) primarily as a form of entertainment, others want to use it for learning, and still others use it as positive way to spend time with family or friends
 - Exhibits that can be enjoyed at each of these levels make it possible for more visitors to get the benefits they're seeking
 - Some visitors also use exhibits in ways that the museum doesn't intend — for irreverence, subversion, or humor, for example — in order to engage with it in a way that feels truer to their personal identity
 - Visitors often photograph themselves mimicking an exhibit in a silly way
 - "I want the exhibit to be for me...if I'm bored by it, I might not take my family with me next time." (Phone interview)

Element #2: Customization (cont.)

- Experiences that engage visitors in a dialogue and allow them to ask their own questions can add to the feeling of customizability
 - When visitors ask their own questions, communication becomes multi-directional, and visitors feel as though they can shape the experience around how they learn and what's interesting to them
 - Visitors naturally ask about topics that they find important, which enables them to make the experience both personalized and relevant
 - Such dialogue puts the experience in visitors' own language, rather than "museum language"
 - "I need a dictionary just to understand some of these labels." (Onsite, MMAH)
- Most museums provide ample opportunity for customization, allowing visitors to easily select what they want to see and do
 - Living history sites, in particular, offer a flexible structure that promotes customization
 - There are no set paths, so visitors feel free to "roam" and pursue what is of interest to them
 - Informal interactions with interpreters provide opportunities for visitors to ask their own questions
- Using personal photography during a museum visit is a common method by which visitors make the experience their own
 - Taking pictures allows them to document what they enjoyed or what interested them; some use it to revisit their actual museum visit and experience it in a new way
 - "I want to take pictures because I can see things [from] different angles after the fact." (Onsite, NMNH)
 - It also lets visitors use the exhibits for their own ends (such as silliness or romance) and for expressions of self-identity
 - We found that observing visitors in NMNH is a powerful reminder of the importance of photography in the museum experience today

Element #2: Customization (cont.)

- Because they want the experience to be their own, visitors don't like feeling "forced" to spend time on topics or exhibits that they find unappealing
 - "I want to be able to ignore different components of the exhibit if I want." (Phone interview)
 - They may avoid interpretive tools that give them that "forced" feeling
 - "Once you put on the headphones [in an audio tour], you're stuck. You can't move ahead to something interesting." (Onsite, NMNH)
 - Typical docent-led tours can make visitors uncomfortable because they have to follow a preordained path (and the group Q&A process on such tours can feel perfunctory and/or intimidating)
 - A lack of information about offerings and schedules can also hamper visitors' abilities to design a personalized museum experience
 - Some visitors expressed a desire to know more about the content of each section of NMNH
 - Many suggested a pamphlet or small guidebook specific to each Smithsonian museum, which described the galleries' offerings in depth (and few seemed aware that such resources exist)
 - For families or other large visiting parties, the ability to spend time only on areas that are of interest is particularly important since they have packed agendas and a wide variety of needs to meet
 - "We need efficient use of our time when we're here [at SI museums]." (Onsite, NMAH)

Element #2: Customization (cont.)

Insights for the Learning Center:

- Offering a wide variety of options, both in terms of topic and exhibit/activity type, would give visitors the "raw material" to customize their Learning Center experience
 - Visitors want a "choose your own adventure" approach to the Learning Center, where they get to mix and match the activities they do and the order in which they do them
 - It is important to avoid obligatory or compulsory activities (including activities that may be perceived as such)
 - It's equally important to acknowledge and support visitors' desire to use exhibits in unintended ways
- A concierge or host who welcomes visitors to the Learning Center and introduces them to its offerings could go a long way toward helping visitors tailor the experience to their priorities and interests
 - This person can ensure that visitors are aware of the choices available to them
 - S/he can also recommend particular "pathways" through the Center based on the visitor's particular interests or desires
- It will be important to make the space photo-friendly and encourage visitors to document various aspects of their Learning Center experience
 - Visitors seem particularly likely to take pictures of:
 - Hands-on activities
 - Visually stimulating environments that include bright colors and monumental objects
 - Places that lend themselves to silliness and humor

Element #3: Immersion

- Among the most compelling informal learning experiences that visitors have are those that fully immerse them in the content by seeming to take them out of the museum setting (often metaphorically or virtually) and transporting them to another time or place
- The physical environment is key to creating this sense of immersion
 - Spaces that physically surround visitors with special, unique objects or theatrical settings help them forget that they're in a museum
 - "I want no glass. There should be real or fake vegetation! And skylights to let in natural light." (Phone interview)
 - In contrast, a familiar or dull setting — particularly one that evokes a traditional classroom environment — can make even interesting topics less appealing
 - "I don't like sterile indoor environments." (Phone interview)
 - "This [image below] looks like an engaging thing to do; the boy is exploring. But it looks like a sterile school background, which is unappealing." (Phone interview)



Element #3: Immersion (cont.)

- Engaging multiple senses is also important to creating a sense of immersion
 - Sight is still the most common and perhaps most powerful sense involved in immersive experiences
 - "The visual is so important for me — it helps me put myself in someone else's shoes for that 'other' experience." (Phone interview)
 - But experiences that involve touch and sound as well are especially successful at forging deeper connections to the content
 - "Touching is better; there's something real about it." (Phone interview)
 - "Getting to see, touch, hear, and do gives me a 'whole experience.'" (Phone interview)
 - "The sounds [in the Arena Spectacular program] made it very real for me! I got to use all of my senses." (Onsite, MMAH)
 - "Getting to touch and hear everything made me more interested in paleontology and helped me be a more intelligent parent. I was able to draw on what I learned when talking to my son." (Phone interview)
- Because immersive experiences help visitors become a "part of it," they can facilitate deeper, more meaningful learning
 - These experiences let visitors understand the content from the inside, rather than from the outside looking in
 - "I feel like I'm a part of the natural world when I'm surrounded by objects and can touch them." (Phone interview)
 - Visitors feel that they can be more playful, theatrical, and imaginative
 - When the experiences seem more "real," visitors find that they can make vivid use of their imaginations
 - "Hearing the sound made it very real for me!" (Onsite, MMAH)
 - Historical times and places, in particular, can be imagined more vividly and more clearly through an immersive environment

Element #3: Immersion (cont.)

- Such deeper connections are associated with more memorable museum experiences
 - Experiences that engage multiple senses create strong sensory memories
 - In part, this is because truly immersive experiences are unexpected (in a museum context), and unexpected situations create more poignant memories
- Authenticity did not appear to be an important component of immersive experiences among the visitors we interviewed
 - Even if visitors know that some aspects of the immersive experience are simulated, they still find the immersion to be an engaging way to understand the content, and preferable to the alternative (authentic but non-immersive exhibits)
 - *“Even if I am in a museum space, a simulation — even in a video — could make you feel like you’re actually on a safari, which would be great!” (Phone interview)*
- In fact, living history sites — which rely on simulations — were frequently cited by visitors as the kind of immersive and engaging learning experiences they enjoy
 - Because the dialogue is unscripted, interactions with interpretive actors provide a dynamic platform for engagement
 - Visitors don’t mind that the staff members are actors, as long as they are knowledgeable and entertaining
 - Such interactions feel more accessible than standard museum content because they are informal, spontaneous, and non-compulsory
 - Skilled interpreters are able to make demonstrations seem spontaneous, even if they are actually rehearsed
 - Visitors enjoy not feeling obligated to stay in one place for a particular length of time
 - The settings at these sites — which involve period buildings, landscaping, and costumes — also play an important role
 - That the setting totally encompasses the visitor gives a strong sense of what it was like to “be there”

Element #3: Immersion (cont.)

- Though less commonly visited than living history sites, archeological digs were also pointed to as examples of successful immersive experiences
 - As with living history sites, digs give participants an opportunity to engage in genuine dialogue with the professionals
 - Visitors enjoy these interactions because they’re informal and the researchers aren’t “lecturing” them
 - The archaeologists or anthropologists involved in digs have added appeal because they are “real” researchers who are knowledgeable about the subject area
 - Getting to participate in the dig gives participants a privileged sense of being a part of the process
 - *“It makes you feel set apart and special.” (Onsite, NMANH)*
 - Watching such research is also appealing, but less so than hands-on participation
- Arena Spectacular (see page 88) provides a different sort of immersive experience, one which is compelling in its theatricality
 - Visitors remarked that the vivid sounds and imagery encouraged them to use multiple senses, which made the performance feel “real” (despite being obviously artificial) and memorable
 - *“The sounds...made it very real for me.” (Onsite, NMAH)*
 - Spectacle and theatricality are examples of the power that entertainment can have as a way to inspire informal learning
 - The National Research Council’s report “Learning Science in Informal Environments” stresses the importance of excitement as a necessary ingredient in successful informal science learning experiences

Element #3: Immersion (cont.)

- Traditional exhibits that present content in glass cases do little to immerse visitors in the context of that content

- Patrons noted that glass creates both a physical and a psychological barrier
 - *"If [my son] sees glass, he goes through [the exhibit] quickly and doesn't stop to look at anything." (Onsite, NMNH)*
- The exception to this is older visitors, many of whom tend to prefer these more traditional (and less hands-on) exhibit styles
 - Immersion remains important for older visitors, but they seek a higher ratio of information-to-participation
 - *"The [positive] 'other experience' comes from the level of detail I get → exhibits in which I can immerse myself in the information." (Phone interview)*



An interesting example of an NMNH exhibit that displays a tool—which could be used in a participatory way—behind glass

Insights for the Learning Center:

- Consider immersive techniques from outside the natural history/science museum realm
 - The live costumed interpreter model is attractive to many because it helps them feel like they're really a "part of the experience"
- Offer opportunities for visitors to "get their hands dirty" — literally or metaphorically — by getting involved in the actual research process
 - Such opportunities require visitors to use multiple senses to engage in and make meaning out of the experience

Element #4: Dynamic content

- Visitors expressed a strong interest in seeing or experiencing action, movement, and change during a museum visit
- Such dynamic content can include motion in a literal sense...
 - Motion attracts their attention and can hold it for extended periods of time
 - *"Seeing something actually moving under a microscope [lens] is really appealing!" (Phone interview)*
 - Exhibit content that is in motion is exciting to visitors because it suggests that they are witnessing something "happen" before their eyes
- Or the dynamism can be about seeing the developmental process behind a static "finished product"
 - For example, instead of seeing an organism or invention as the end result of natural or scientific processes, visitors want to see the changes and transitions that occur(ed) in the course of its development
 - *"There's this fascination with the process—we want to know how we got to the finished product." (Onsite, MMAH)*
 - For some, this interest in process also applies to NMNH's scientific research: a few respondents expressed an interest in learning more about the work of the museum and the people involved in it
 - However, this was not universal: some have little interest in this kind of process
 - *"I don't care about the process. I'd rather see 'what is.'" (Phone interview)*

Element #4: Dynamic content (cont.)

- For many, seeing something happen is more informative than merely reading about it
 - Directly observing change or motion helps visitors understand the concepts at work and makes them feel closer to the content
 - It is also more fun because it can involve surprise (as when unanticipated things happen) and theatricality (when the dynamic content is presented in demonstrations or live experiments)
 - It should be noted that “seeing” things happen can encompass far more than just sight: touch, hearing, and smell are all frequently involved in the direct observation of change
 - Dynamic content may also better equip visitors to develop their own narrative of their museum experience — the story they take home with them and share with family and friends
- Dynamic content appeals to visitors of various ages
 - Even if young children don’t understand what is taking place, they find motion stimulating and interesting
 - And adult visitors find seeing something move and change more intellectually challenging than seeing or interacting with a static object
- As with most natural history museums, NMNH’s exhibits tend toward the static
 - This focus on things that *used to be* changing can give the museum a sense of “dead-ness” rather than activity
 - “NMNH is more about dead things.” (Phone interview)
 - “Everything here is static, like a sculpture. We want to see richer visual things — things that move!” (Onsite, MMAH)
 - NMNH’s many “live” exhibits (ants, butterflies, bees) are appealing but are not a focal part of the NMNH experience
 - Many do not even see these exhibits because they are not centrally located

Element #4: Dynamic content (cont.)

- By contrast, zoos and aquariums are viewed as naturally providing opportunities to see things “happen”
 - Zoos and aquariums offer life — and living things naturally display motion and change
- Visitors mentioned science centers as good models of how to incorporate liveliness without living collections
 - They frequently feature on-the-spot experiments which make change visible and palpable to visitors
 - Even better, they often provide opportunities for visitors to conduct their own mini-experiments in hands-on exhibits, which gives first-hand experience with scientific processes
 - However, the “looking through a microscope” approach to hands-on science is less appealing — particularly when it evokes memories of school science classes in which little actually happened
 - “Ugh! That reminds me of science class. I could never get anything to move under the lens.” (Onsite, NMNH)

Element #4: Dynamic content (cont.)

Insights for the Learning Center:

- Live experiments, in which there are perceptible and frequent changes, are obvious opportunities to provide dynamic experiences within the Learning Center
 - Experiments in the Learning Center can also be used as a gateway to deeper engagement with the rest of the museum; for instance, hands-on experiments involving rocks and minerals in the Learning Center can augment visitors' experiences in the Hall of Geology, Gems, and Minerals
- The Learning Center can also provide access to a unique form of dynamic content: the process of museum work
 - As we discuss, there is notable interest among some audiences to understand behind-the-scenes processes and decision-making at NMNH
 - The Learning Center can tap into that interest by providing opportunities to see research work in action and making visible the thinking that goes into what to display in the museum's galleries and how to display it

Element #5: One-of-a-kind experiences

- Seeing or experiencing something that is unique — in the absolute or in that visitor's experience — can be an important part of a memorable museum experience
 - Visitors hope to do or see something extraordinary in a museum — something decidedly different from what they see and do every day
 - *"Museums provide a special context that I don't get to experience everyday." (Phone interview)*
 - *"I can always see things on TV or the computer. It's more special if you can touch [things]... Being there in person is infinitely better because I can see it with my own eyes." (Phone interview)*
- One-of-a-kind experiences can involve objects and exhibits that are of a size and scale that is uncommon in daily life
 - Visitors are impressed by dramatically big specimens: the seemingly larger-than-life dinosaur exhibits and the elephant in NMNH's rotunda are big draws
 - These are also often photographed by visitors to document the uniqueness of the experience
- Being around rare objects also gives visitors the sense of experiencing something special and unique
 - Museums house many precious or unusual artifacts that visitors would never encounter in their daily lives and therefore contribute to an aura of "specialness"
- Whether monumental or rare, these experiences can feel "large"
 - This largeness can be about the experience or the museum itself; some visitors think of visiting big, landmark museums as notches in their "cultural belts"
 - And they proudly list the landmark museums they've seen
 - *"We did the Monterey Aquarium and Sea World in Florida...we've done them all." (Onsite, NMNH)*
 - They look forward to telling stories about their special experiences to friends and family afterwards

Element #5: One-of-a-kind experiences (cont.)

- One-of-a-kind experiences give participants something to think about after their visit
 - Special experiences often encourage deeper reflection post-visit
 - “[The museum] experience spawns an introspection after the fact.” (Phone interview)
 - They can also become interesting memories that patrons enjoy revisiting and recounting
 - Visitors like to take back souvenirs to provide vivid reminders of what they experienced
 - Photography is a popular method
 - Items from the gift store can also be appealing, but not as accessible due to cost
- Media and technologically-mediated experiences have raised the bar for what constitutes a truly one-of-a-kind experience
 - Technology is seen as competing with museums in providing informal learning experiences, despite the fact that museums have been actively incorporating technologies in their exhibits and online
 - “In a way, the movie industry has spoiled us for natural history museums...but we still go to them.” (Onsite, NMAAH)
 - “We were deciding where to go and what to do on the Mall earlier today, and I said ‘let’s see this and this,’ but my son said, ‘why should we waste our time on that today? We can just Google that one when we get home!’ And he made a very good point.” (Onsite, NMAAH)
 - Museums need to provide something that can’t be replicated at home on a computer or TV to be compelling
 - “We need something that can’t be on the computer when we’re here [on the Mall].” (Onsite, NMAAH)
- Large-scale, vivid encounters like Arena Spectacular can successfully tap into this desire for a memorably unique experience
 - “Where else are you going to get to see dinosaurs fight?!” (Onsite, NMAAH)

Element #5: One-of-a-kind experiences (cont.)

- NMNH’s unique and vast collection is an important part of what makes NMNH special and “worth the trip” for its many visitors
 - Objects like the dinosaur mounts and the elephant are impressive in their physical scale, while something like the Hope Diamond is experientially “big” because it epitomizes rarity and value

Insights for the Learning Center:

- Offering one experientially large, hard-to-come-by experience can make the Learning Center a “can’t miss”
 - Such an experience can become a focal point that draws visitors to the Learning Center
- Be sure to provide visitors with high-quality and unique souvenirs to enhance the “memorability” of the experience
 - These could include the output of an activity that visitors engage in while at the Learning Center
 - And providing and facilitating opportunities for visitors to take photos of their experience is essential to such memory-making

Element #6: A sense of wonder

- Many visitors want museums to introduce them to information and ideas they haven't come across before or to experiences they didn't expect to have
 - Visitors experience a pleasant sense of discovery and wonder when learning about something that they hadn't considered or encountered before — particularly when it's presented in ways that let them make connections between their prior knowledge and the new concept
 - These “ah-ha” moments give visitors a satisfying sense of accomplishment, reminding them of their capacity for understanding and synthesizing information across different domains
 - “A-ha” moments can be particularly engaging as learning experiences because they inspire further knowledge-seeking beyond the museum visit
 - “Exhibits are great jumping-off points for me; I love to explore the things I learned at home.” (Phone interview)
 - In fact, when new information can't be connected back to visitors' existing knowledge base, the experience is less satisfying and can feel confusing to visitors
 - So making new information relevant to visitors is important as a way to anchor that sense of wonder
- **New ideas and information are made particularly vivid when they are presented in conjunction with tangible objects or, better yet, activities**
 - Abstract scientific concepts (for instance, evolution) are more accessible when they're represented by objects (e.g., fossils), which serve as entry-points
 - These make the information more concrete and vivid than simply reading about the concept would
 - For most visitors, multi-sensory, hands-on activities can heighten this engagement further
 - “Doing hands-on things in museums is always a plus because I probably haven't done things like that before.” (Onsite, NMAH)
 - Some visitors also enjoy working with equipment and tools they have little experience with

Element #6: A sense of wonder (cont.)

- Museums and science centers are seen as skilled at delivering novel information
 - Visitors think of them as places to encounter new facts or ideas, and they appreciate the variety of topics that these museums give them access to
 - But some feel that the typical interactive exhibits have become too commonplace
 - A perceived over-use of some hands-on interactives works against the capacity of museums to provide a genuine sense of wonder
 - For instance, touching the Van de Graaff electrostatic generator has long been a stock experience at science and children's museums and no longer provokes the kind of wonder that visitors hope to get out of their museum experiences
 - This is particularly true for adults, some of whom complain that the interactive exhibits seem to be targeted at young children
 - “I've never seen a hands-on place geared towards adults. We want something challenging for us. We usually just walk by and watch the kids.” (Onsite, NMAH)
 - “When I see kids in a crowded hall, I don't like it. I want an exhibit for me...Adults are part of the museum-going public too!” (Phone interview)

Insights for the Learning Center:

- Make sure that visitors are given the opportunity to reach their own conclusions about the significance of Learning Center experiences and activities — in other words, to have their own “a-ha” moments
 - Staff interactions will be critical to facilitating these “discoveries” and making sure that visitors are given the time and space to come up with their own answers before offering the “expert” take

Key Findings: In-depth Visitor Interviews

Elements of an ideal museum experience

Interacting with NMNH collections, scientists, and research work

Other opportunities to make science relevant

Additional considerations

Interacting with NMNH collections: Visitors have little specific knowledge of how NMNH's research collections are used

- Visitors are vaguely aware that NMNH's holdings extend beyond the objects that are on display in the public galleries
 - But they have little knowledge of the collection and the museum's collecting and research programs
 - This is consistent with past NMNH research on public awareness of the extent of the museum's holdings, as well as with findings from other natural history museums
- For many, what knowledge they do have of NMNH's collections comes from the film *Night at the Museum: Battle of the Smithsonian*
 - The film appears to have been a major success in illuminating the size of NMNH's collections for many visitors
 - "The movie showed us that a huge percentage [of the collection] isn't on display!" (Onsite, NMNH)
 - Because of it, many respondents expressed a genuine interest in learning more about the behind-the-scenes world of the museum
 - When asked where they would most want to have a behind-the-scenes experience, many named NMNH — expressly because of what the movie suggested about the museum's non-displayed holdings
- Visitors imagine a complex decision-making process within the organization to determine which objects are displayed and which remain in storage — and they are interested in understanding more about how such decisions are reached
 - This process is inherently interesting to some, as we discuss in greater detail on pages 45 and 46
 - Others suspect that the research collections are comprised primarily of multiples of the same type of specimen, and they find that redundancy unappealing
 - "Repeated objects are kind of boring. I don't need ten different types to understand the thing." (Onsite, NMNH)

Interacting with NMNH collections: In general, visitors are ambivalent about the idea of interacting with collection objects

- For many, collection objects are an integral part of the natural history museum experience — but sometimes just being in the presence of such objects is sufficient
 - Some visitors say that observing objects and reading texts about them can meet their needs
 - *"I can be removed from the things. Visual and auditory are most important to me." (Phone interview)*
 - *"I just want a lot of information about the exhibits." (Phone interview)*
 - Others expressed a low-level interest in interacting with objects, but had a hard time articulating why this might be appealing — and found other modes of interacting with NMNH much more compelling
 - For both types, objects may be a draw of the museum itself, but the opportunity to interact with or handle objects wouldn't be a big enough "value-add" to attract them to the Learning Center
- Others voiced an explicit preference not to interact with objects
 - They feel that handling objects requires "work," which is inconsistent with the leisure- or vacation-time quality of a museum visit
 - They prefer to watch and "relax," not put in active effort while at a museum
 - *"I don't want to participate too much, but would rather watch...something where I'm secure in a chair." (Onsite, NMAH)*
 - We noted that these interviewees tended to be older museum visitors
 - These people may be used to, and content with, conventional museum exhibits
 - It may be possible to engage them successfully in certain kinds of object interactions, but they may need more persuasion (or different approaches) than other audiences

Interacting with NMNH collections: Those who do want to interact with objects expect an intimate, memorable experience

- Interacting with objects would allow them to "get closer" to the subject matter
 - This intimacy may inspire a more informative learning experience than a typical object encounter in museum galleries, because it engages more senses
 - Merely seeing objects is the norm in museum settings, so directly interacting with them would be different and therefore potentially special for some visitors
 - *"When there was no glass between me and the objects [and I could touch them], I felt closer to the action and content...it made everything more intimate for me." (Phone interview)*
 - *"Touching brings you closer to the objects and remember them more. I wouldn't remember things from a glass case as well." (Phone interview)*
- Handling objects can also render the experience more memorable
 - Because most visitors expect museums to keep the objects at a distance from them, the opportunity to do this could be a special, one-of-a-kind experience, and consequently more memorable
 - *"I'm much more likely to remember it if I can do more than just see it through glass." (Phone interview)*
- Most of those who want to interact with objects want direct contact with them
 - Visitors were drawn to images of people handling specimens and working with their hands
 - They don't want their interactions to be mediated by run-of-the-mill scientific equipment, such as microscopes
 - Microscopes can conjure negative memories of science class in school or can intimidate visitors
 - *"Scientific stuff is intimidating because it's advanced and hard to understand." (On site, NMNH)*
 - That said, handling rare, cutting-edge equipment can be a draw in and of itself



The above image was appealing, while some respondents were lukewarm about the image below.



Interacting with NMNH collections: For many visitors, the authenticity of the objects they handle or see is not a high priority

- Many respondents acknowledged that they cannot tell the difference between real and simulated objects
 - When it comes to interacting with objects themselves, handling a realistic simulation would be just as special
 - In their minds, simulated objects are connected with the idea of safety, both for the objects and for themselves
 - “I don’t want to destroy [the objects]!” (Onsite, NMNH)
 - “I want a simulation [for the activity] if the machine could be dangerous.” (Onsite, NMAH)
- But for others, only authentic objects are appealing
 - Real objects are a unique, special privilege of museum visitation
 - “I get disappointed by fakes; I can see a fossil copy at Toys-R-Us.” (Onsite, NMAH)
- This issue may warrant further study during the development of prototype experiences for the Learning Center and the formative evaluation phase

Interacting with NMNH scientists: Visitors’ perceptions of scientists are informed by stereotypes

- Visitors’ images of NMNH scientists are based for the most part on their stereotypical impressions of scientists in general
 - Most of these perceptions are negative: visitors use words like *nerdy*, *introverted*, and *awkward* to describe typical scientists
 - They acknowledge that these impressions are not necessarily based on personal experiences with scientists, but the perceptions are firmly held nonetheless
 - These stereotypes give rise to genuine concern that interacting and communicating with “real” scientists in the Learning Center would be difficult and unrewarding
 - They worry that the distance between themselves and the scientists — in terms of level of knowledge, culture, and communication style — is too great to allow for meaningful dialogue
 - “Scientists wouldn’t be able to talk about the information on my level.” (Onsite, NMNH)
 - “There is a chasm between NMNH scientists and the public.” (Phone interview)
 - “I know this is a stereotype, but I think scientists usually can’t communicate with other people very well.” (Phone interview)
 - “There’s definitely a chasm between the museum audience and scholars, which is a shame.” (Phone interview)
 - Visitors also anticipate that scientists might have little interest in or time for interacting with the public
 - For some, public education is not presumed to be part of scientists’ responsibilities
- Some visitors hold more positive perceptions of scientists and associate them with charisma and interesting, first-hand stories
 - Some think of scientists as “characters” — people who are eccentric and entertaining to talk to
 - They use words like *curious*, *passionate*, and *renaissance men and women* to describe scientists
 - They perceive that scientists have interesting backgrounds and experiences in the field, and they would like to hear about these

Interacting with NMNH scientists: Visitors are eager to interact with NMNH people — but that doesn't necessarily mean scientists

- Visitors do want to interact with people, and they want those people to have deep knowledge of the material and a passion for the subject matter
 - Expertise is important because it's directly related to the quality of information a staff member can provide and the richness with which she can convey that information
 - *"Experts can tell rich stories from experience, while amateurs can only recite facts."* (Onsite, NMNH)
 - *"Non-experts just memorize scripts."* (Phone interview)
 - Deep knowledge is integral to visitors' assessment of whether an NMNH representative is a "legitimate" source of information or not
 - Visitors find it disappointing and frustrating when museum staff can't answer their questions
 - Some have negative memories of their interactions with docents who seemed to know no more than they did
 - They feel that excitement about the subject can be contagious: an enthusiastic communicator can engage them in a subject that was initially of little interest
 - *"Someone who can communicate their enthusiasm will make me want to do that too."* (Phone interview)
 - *"Some scientists are so blown away by their own work and passionate about their subjects of knowledge; their enthusiasm is catching."* (Phone interview)
 - *"We stopped by the Mall today, and this young engineer talked to us about his design for a sustainable home. He was so excited about it that I found myself so interested to talk to him. And I don't even care much about natural gas!"* (Onsite, NMNH)
- But visitors don't believe these characteristics are the exclusive purview of credentialed scientists
 - They feel that they can learn just as much — if not more, and more pleasurable — from other types of museum staff who are as knowledgeable as scientists but may be better communicators
 - Museum educators and other types of facilitators can serve the function of "experts" for visitors
 - *"Educators have a special skill set that others don't have...they're so important in learning situations because they communicate well."* (Phone interview)

Interacting with NMNH scientists: Charisma and story-telling ability are desirable traits in scientists and non-scientists alike

- Visitors are drawn to those who can entertain them while also relaying solid scientific knowledge
 - A charismatic facilitator can engage visitors on several levels at once: intellectually (with intriguing information) and socially (through informal dialogue with the facilitator)
 - The facilitator's personality and conversational skills are key to engaging visitors on these levels
 - Interpreters at living history sites are seen by some visitors as good models for the appealing combination of deep knowledge and the ability to entertain
 - *"The instructor should have a fun voice and be friendly."* (Onsite, NMNH)
- Visitors also want to interact with people who can share personal stories from their own experience
 - They're interested in hearing vivid, memorable stories from many different types of insiders, including scientists and researchers
 - *"I want to meet characters, mad scientists, the philanthropists who enable [all of the work that is done in museums]—the quirky people!"* (Phone interview)
 - *"I would even like to hear from the maintenance guy [at the museum]. That person would have some good insight about the museum too."* (Onsite, NMNH)

Interacting with NMNH scientists: Interactions that enable bidirectional communication are preferred

- Visitors react negatively to the idea of being “talked at,” as they often are during tours or lectures
 - Lectures and other formal learning contexts make some visitors feel constrained in how they relate to the expert or facilitator
 - They can connect to the material more directly if they can engage in looser, more dialogue-like communication with expert staff
 - This “two-way street” approach to communication is particularly important in the context of participatory activities (such as those envisioned at the Learning Center)



Some interviewees feel constrained by the format of organized tours in museums.

- But a few visitors do favor traditional unidirectional communication in learning situations
 - They say they can “absorb” the information better in these contexts
 - “I’m an academic learner; I like to hear lectures, read books, and exhibit labels.” (Phone interview)
 - These respondents were typically adults, whether visiting alone or with their children or grandchildren

Interacting with NMNH scientists: A deep need for intellectual comfort underlies many of these preferences

- Despite their interest in science, many visitors find it an intimidating topic
 - Much of this intimidation stems from negative memories of primary school science classes and their science teachers — which left them feeling confused about science rather than enlightened
 - “I have to do everything for a grade in classes. We read out of the textbook too much, and then I forget a lot of the reading, and then worry about being wrong.” (Onsite, NMNH)
 - They remember not feeling comfortable with the special equipment, such as microscopes
 - “It wasn’t fun because I could never see anything happening [under the microscope lens] and wasn’t sure if I was doing it wrong.” (Onsite, NMNH)
- They want a museum to give them a different kind of science experience — one in which they feel comfortable with their own “role” in the setting and feel that the content is accessible to them
 - They look primarily to museum staff to provide them clear information about activities, experiences, and exhibits, as well as guidance on how to participate in or interpret an activity
 - “I need someone to walk me through all of the details. I hate feeling confused when I’m doing things by myself.” (Onsite, NMAH)
 - “I’m a very curious person, but self-direction won’t get me anywhere in the beginning [of the activity].” (Phone interview)
 - They want to interact with representatives of the museum who can provide some guardrails for the activity: the objectives, expectations for their involvement, and a sense of whether they’re “doing it right”
 - “Doing it right” is especially important when visitors have an opportunity to assist the museum in its work through their participation
 - Participating “correctly” also yields higher satisfaction and a greater sense of accomplishment in the experience
 - These expectations show that patrons, particularly adults, want to take activities seriously: they dislike frivolous activities, which they consider to be unworthy of their time

Interacting with NMNH scientists: A deep need for intellectual comfort underlies many of these preferences (cont.)

- They expect that experts and other museum staff members will be able to provide both theoretical background and technical know-how
 - In addition to getting practical information about how to participate, they like hearing nuanced information about the context of the activity
 - “I want to hear the history of the things I’m working with in activities.” (Phone interview)
- Having opportunities for informal, bi-directional communication with experts is critical to providing visitors with intellectual comfort
 - They want to be able to ask questions about activities and content — but not necessarily in a formal Q&A session
 - They trust staff members more than written information, in part because staff are more responsive to their specific questions
 - Such opportunities are, therefore, important to making the experience personally relevant; they enable visitors to engage with the museum on *their* interests and priorities — not the museum’s

Interacting with NMNH research work: Little is known about NMNH’s research work—but it’s appealing when exposed

- Many had never really considered NMNH’s research activities, despite knowing that a lot of work goes on behind-the-scenes to create the public experiences
 - “We know there’s a lot that goes into exhibit design, but we don’t know much about the science work.” (Phone interview)
 - Even those who have a high level of involvement with NMNH — as lifelong visitors and participants in lectures or other events — admit to knowing very little about the work that goes on behind the scenes
 - “I’ve been going to NMNH for years...I am totally unfamiliar with the scientists and their work.” (Phone interview)
 - Only those who are very “inside” at NMNH or in the museum field had a strong sense of the research work that goes on
 - > “[From my internship at NMNH] I know that the Smithsonian is not just ‘America’s attic.’ These objects aren’t collecting dust—there’s real work being done!” (Phone interview)
- But the notion of NMNH’s research function piqued many visitors’ interest once it was pointed out to them
 - In particular, they like the idea of a space that would give them the opportunity to be “part of the museum’s work”
 - Being exposed to and engaged in the “real” work of the museum would feel like a special privilege
 - “We’d love to do activities with objects, and to tie it up into the whole process of museum work. I would be happy to spend more than an hour or so on something like that!” (Onsite, NM/AM)
 - “I feel set apart and special when I work with objects.” (Phone interview—with a non-SI museum employee)
 - Those who came across the FossilLab while researchers were working in it found it very interesting

Interacting with NMNH research work: Making behind-the-scenes work more transparent is of interest

- Some visitors are interested in knowing more about exhibition-related processes at NMNH
 - Visitors want to learn about how NMNH makes decisions about displaying some objects while keeping others in storage
 - “We’d like to see the guts of the museum.” (Onsite, NMAAH)
 - Some patrons understand that what they see on display is the end point of a process of collecting, researching, and exhibition design and installation — and they want to learn more about the details of this flow
 - They want insight into the whole process, from research to exhibit design to display
 - “I want to know the decisions that were made with the exhibits. Why is what I’m looking important? Why did they choose this topic?” (Phone interview)
 - It should be noted that many visitors believe this (supporting the exhibit design and display process) to be the primary role of research in NMNH
- However, a small segment felt that the work of the museum might be “over their heads” or require more effort than they would want to put in
 - “I might be interested in what scientists do, but a lot of it is so esoteric.” (Phone interview)
- For these visitors, observing is more appealing than actually getting involved in the work of the museums

Key Findings: In-depth Visitor Interviews

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Additional considerations

Making science relevant: Many have a pre-existing interest in science, but feel that NMNH could make it more relevant

- The NMNH visitor base has, on balance, a strong predisposition toward science learning
 - *"I'm not professionally involved in science, but I've always pursued learning about it."* (Phone interview)
- And their experiences at NMNH help deepen and reinvigorate their interests in particular science topics
 - *"It intensified my thinking about a subject I was concerned about...it brought it to life."* (Phone interview)
- But they also want to use the museum as a way to make sense of their lives outside of the museum
 - *"We use [museum visits] as a way of explaining the world, of life in general...they can show how we fit into the environment and the world."* (Phone interview)
- In general, they feel that NMNH does better at drawing connections between scientific facts than at drawing connections between those facts and their daily lives
 - They want to understand how objects at a museum relate back to the ideas and tangible things that they encounter on a daily basis
 - *"The cotton gin is great, but what does it mean to me? They should hang up a cotton shirt next to it, or show an example of what it produced back then. It just looks like a machine frozen in time to me right now."* (Onsite, NMMAH)
 - Current national issues that are science-related are fertile areas of interest and engagement
 - *"It would be great to study bacteria or things like deer ticks, which are relevant to everyone right now."* (Phone interview)
 - So are opportunities to learn about themselves: their health, the human body, and the human mind
 - *"If I could learn more about how the chemotherapy affected my body, I would feel so much more knowledgeable about myself. I felt uninformed during the whole thing. I still feel confused!"* (Onsite, NMMAH)

Making science relevant: Activity-based experiences can forge connections to visitors' own interests

- Involving visitors in "the process"—scientific processes, interpretive processes, or the museum's internal processes—is an important pathway to engaging them at that personal level
 - Multi-step, participatory activities engage visitors in the process in ways that just touching an object or observing a scientist don't
 - These kinds of activities also engage visitors on a more personal level
 - Particularly when activities allow visitors to contribute their own opinions or ideas to the museum or to provide assistance to staff members
 - Getting to try something out for themselves involves them as active, rather than passive, participants in the museum experience
- At a more practical level, activities can be incorporated into the museum more flexibly than exhibits can, so they allow the museum to respond more nimbly to current events
 - In other words, activities can make it easier for the museum to adapt content in accordance with trends outside the museum's doors
 - This helps keep the museum relevant to visitors' daily lives
- Visitors like the idea that activities could connect the public and back-of-the-house functions of the museum
 - Activities can make the "work of the museum" more transparent by illuminating the process by which the public spaces and exhibits came to be or by actively engaging visitors in the museum's research processes
 - This can help break down the perceived physical and psychological barriers between the public and the museum, as well as those between objects and visitors
 - Being able to contribute something to the museum is important to some visitors

Making science relevant: Activities also provide other desirable elements of a museum experience

- Activities can be customized to individual preferences and strengths
 - Activities that don't have just one "right answer" enable visitors to pursue lines of inquiry that reflect their personal interests
 - Activities can provide a broad spectrum of modes of participation, from utterly hands-on to more observation-oriented
 - They can meet the needs of larger visiting parties, while still giving them an ideal opportunity to do something together
 - "Family activities are fun because I can help the boys, and also learn something myself." (Onsite, NMNH)
- Participatory activities also immerse the visitor in the experience and can engage multiple senses
 - An activity that involves classifying minerals, for example, immerses visitors in the world of a scientific research lab better than an exhibit behind glass can
 - It also enables them to apply what they've learned from the museum (identifiable features in the specimens, the system of classification, etc.), which enhances the learning experience
- Because they're process-oriented, activities are inherently dynamic
 - They allow visitors to see literal or symbolic movement, change, and progress
- Since visitors perceive NMNH as a one-of-a-kind, wondrous place, activities at NMNH can also seem unusual, special, and privileged
 - Particularly if activities give them special insight into NMNH's behind-the-scenes world or engage them in the museum's work

Making science relevant: Visitors want experts to be available so that activities aren't purely self-guided

- They want to be able to ask knowledgeable staff questions about process and interpretation
 - This can give visitors the desired degree of intellectual comfort — it confirms that they're conducting activities correctly and lets them turn to someone who can guide them when uncertainty arises
 - Having staff around to get visitors started on an activity can ensure that the goals and expectations are clear
 - When they don't have a lot of information about the steps or goals of an activity, visitors tend to get frustrated
 - "I don't want to push buttons just for the sake of pushing them...I want there to be an important purpose behind those activities." (Phone interview)
 - Quick and easy comprehension of what an activity is and how to start is critical, because visitors may dismiss something that they can't decipher
 - "If that activity has no immediate meaning for me, I'm uninterested." (Phone interview)
 - This was apparent in the card sort exercise itself: when interviewees couldn't instantly understand what was going on in the image, they put it to the side without further consideration
- But they don't want activities that are purely supervised or other-directed; once they understand and can effectively participate in an activity, they want some freedom to pursue it themselves
 - A measure of self-direction allows visitors to implement the knowledge they've gained through interactions with staff members
 - "I want a lesson and demonstration first, and then time to work by myself once I know how to do it." (Onsite, NMNH)
 - It also increases visitors' ability to make their own discoveries and identify personal connections to their worlds

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Additional considerations: Visitors with special needs

- NMNH’s approach to different elements of the Learning Center will likely need to be adjusted to meet the needs of visitors with physical or developmental disabilities
- For visitors in wheelchairs, activity tables should be on wheels and be easily adjustable in height
 - This would also give NMNH added flexibility to rearrange the Learning Center or move Learning Center-based activities out to the rest of the museum
- Visitors with autism spectrum disorders find overly-stimulating spaces to be a challenge
 - Bright colors, bold designs, and loud noises can overwhelm these visitors to the point of extreme discomfort—which may necessitate an early departure from the museum
 - The ability to control sound levels in accordance with personal needs is also important to families with a child with an autism spectrum disorder
 - Crowds are also a concern as they can spark anxiety and discomfort
- Visitors with behavioral disorders that affect attention span appreciate activities that are brief or can be partitioned
 - Brevity can ensure that these participants will be able to complete the activity while they are still attentive
 - One family noted that it is difficult to stay in one place for long periods of time, but they can often resume an activity after a “break”

Additional considerations: The needs of caretakers who bring children to the museum

- Older visitors and the adult members of intergenerational visiting groups often need a chance — and a space — to rest during their museum visits
 - NMNH and other museums offer a great deal to see and do, particularly for children, and areas of play or participation are popular
 - These areas often become noisy and chaotic
 - For some, this part of the museum visit becomes stressful
 - Many adults are content to let the children in their groups explore on their own, and subsequently find themselves with little to do except stand nearby (or sit, in the best case scenario)
 - Even activities that are designed for joint participation by children and adults often leave adults feeling unengaged — or they'd just prefer to rest while their children participate
 - These weary adults may appreciate a space specifically set aside for rest while the children participate in activities
 - To be comfortable with such a space, adult caretakers need to be able to see their kids from this resting space

Key Findings: Peer Best-Practices Review

Peer institution profiles

Summary of key concepts

Peer Institution Profiles:

NASA Jet Propulsion Lab's Open House

- NASA created the Jet Propulsion Lab (JPL) as an R&D engine for the space exploration program in the 1930s
 - The lab is still operating as a vital part of NASA's research
 - It is based at the California Institute of Technology in Pasadena, CA
- Every year NASA's Jet Propulsion Lab holds an Open House for one weekend
 - For the event, the JPL opens its doors to the public to present its research, scientists, and objects
 - The Open House is typically held during May or June



- The JPL Open House provides a variety of things for visitors to see and do, including myriad activities, demonstrations, and exhibits

- Visitors can choose from offerings like walking through research labs, viewing “live” robot demonstrations, and talking with scientists one-on-one
- They can wander freely among the open house’s indoor and outdoor spaces



A simple activity that could be completed at the Open House or taken home

- This sheer volume of things to see and do creates a fun, festival-like atmosphere

Peer Institution Profiles:

NASA Jet Propulsion Lab's Open House (cont.)

- The event is particularly well-suited for families
 - The variety of activities ensures that there is “something for everyone”
 - Many activities involve physical participation which appeals to kids
 - However, some adult reviewers complain about the preponderance of child-focused activities and a lack of adult-oriented themes
 - The fact that the scientists and volunteers seem particularly excited to talk with children helps make the event a success with families
 - They involve kids in their demonstrations and get “on their level” in one-on-one conversations



- Visitors also get opportunities to interact with “real” scientists in personally meaningful ways
 - The scientists are able to craft engaging stories about science by sharing personal anecdotes
 - Visitors also get to ask their own questions about the topics that are of greatest interest to them personally
 - “Where else are you going to be able to chat with a scientist about whatever you want because he’s in the ‘Ask a Scientist’ booth and subject to all your silly and possibly even stupid questions?” (Independent review)

Peer Institution Profiles:

NASA Jet Propulsion Lab's Open House (cont.)

- The Open House makes “real” science accessible to a wide audience
 - The free admission makes it financially accessible to a broad cross-section of the population
 - The way that it presents science in a fun, informal way makes it accessible to those who don't come to it with a predisposition toward science
 - “It was a fun event for kids of all ages and anything that makes something as potentially daunting as science accessible is worthwhile.” (Independent review)
 - It appeals to people who don't necessarily have a deep interest in space research
 - “Even if you don't care about space, there's something for you.” (Independent blog)
 - The conversations with scientists and volunteers go a long way toward keeping the tone casual and informal



- In large part, the “special-ness” of the Open House comes from the fact that it provides access to spaces, objects, and people that visitors can't get to otherwise
 - Visitors can walk through the places where cutting-edge research and science are done
 - “To think that this is the place where people keep in contact with robotic craft millions, or billions, of miles up in space—at other worlds—is truly awesome.” (Independent review)
 - Visitors get to see space objects they have heard about through TV and media

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National Museum of Natural History 58.

Peer Institution Profiles:

The Apple Retail Store

- In 2001, Apple began to build retail stores in select U.S. cities
 - The stores are for more than just purchasing Apple products—they are intended to be spaces where Apple users can gather, learn, and create
 - Most of the stores were immediately successful in terms of popularity and user approval; there are now over 200 locations worldwide
- Despite being a commercial enterprise, each store also has the broader “mission” of integrating itself into the community
 - Each store strives to reflect its community's uniqueness: stores often serve as venues for concerts, talks, and presentations by local and international figures
 - Ultimately, the Apple stores want to be a “gift” to their communities by supporting their users' learning, creativity, and growth
 - Individual stores partner with nearby schools and business owners for educational purposes



Photo and caption from an independent blog: “An Apple Store employee shows off an iPhone. We got to touch this iPhone; we passed it around the line and played with it while we waited.”



- Visitors can see and use the objects on display

- “Everything is much more accessible with more Macs to touch and play with.” (Independent blog)
- Users have composed music and even written books in Apple stores

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National Museum of Natural History 59.

Peer Institution Profiles: The Apple Retail Store (cont.)

- One of the unique attributes of Apple stores is that Apple “geniuses” are available for face-to-face assistance
 - These specialists are both enthusiastic and knowledgeable
 - They are hired for their customer service skills but given rigorous technological training
 - They are positioned throughout the store and behind the “Genius Bar” to answer users’ questions and to demonstrate the products
 - The experts are easily identifiable in their distinctive yet casual clothing



- The stores make use of both these experts and other staff to tailor the shopping experience to each visitors’ unique needs
 - The focus is on providing live support to every person who uses the store
 - Concierge staff work with visitors who may not be sure of what they want and direct them to the appropriate experience
 - The One-to-One program gives Apple users step-by-step instructions and advice on how to use their products at home and in the office
 - The experts tailor tutorials and group sessions to meet visitors’ needs and schedules; the lessons can be designed as part of a series that is included in the price of an Apple product
 - The Genius Bar assists directly with troubleshooting

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National Museum of Natural History 60.
(Credit: Tom Kraatz/CNET Networks)

Peer Institution Profiles: The Apple Retail Store (cont.)

- The structure of each store is designed to be flexible
 - Stores are seen as forums for experimentation; the space within the stores can be literally changed to accommodate new Apple features
 - For example, the iPod bar that came with all of the new stores was removed to make way for the Studio for the One-to-One program because the bar was not as successful as they expected
 - Employees’ roles are also adaptable to evolving retail situations
 - Since the stores have opened, the roles of Creative and Concierge have been introduced
 - > Concierges act as guides to the Apple stores
 - > Creatives provide training sessions in One-to-One, and are often experts in the high-level Apple applications
 - This flexibility enables the Apple stores to respond to their customers’ evolving needs and interests in a timely way

- The stores provide an exciting, vibrant atmosphere

- Stores bustle with activity as users try out new products, and employees talk with customers
- Both employees and store visitors are excited about being there, an attitude that is contagious
 - With each new store opening, there is significant buzz in the media—some customers wait in line for hours to be the first visitors



Flickr, John Bieher

A store visitor captures the scene at a Vancouver Apple store, as other visitors take their own pictures

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National Museum of Natural History 61.

Peer Institution Profiles: Weston Family Innovation Centre at the Ontario Science Centre

- In 2006, the Ontario Science Centre opened the Weston Family Innovation Centre not as an exhibition space, but as a place that encourages innovation and creativity in young people
 - The Ontario Science Centre has always sought to engage visitors with science in inspiring ways—the Innovation Centre is the newest and most dramatic effort
 - The Centre seeks to inspire visitors' creativity and actively engage them in problem-solving, particularly in relation to real-world issues
 - The Weston family also sponsors a design contest for youths, and the winners' projects are displayed in the Centre

- The Centre is designed as an immersive and visually-stimulating environment

- The space literally surrounds patrons with vivid images and materials

→ The floors, walls, and ceilings are covered with lights, objects, and display screens



flickr, Orion

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National Museum of Natural History 62.



- This visual-ness is central to the Centre's mission to merge art and science in a way that makes science objects aesthetically compelling

- Visitors are also immersed in a high volume of information
 - Information is communicated through activities, multimedia presentations, and through employees

Peer Institution Profiles: Weston Family Innovation Centre at the Ontario Science Centre (cont.)



- The Innovation Centre engages visitors in the process of doing and creating
 - Activities and staff challenge visitors with problem-solving activities, such as imagining new ways to address global warming
 - Visitors can build, design, explore, and experiment
 - "[It is] a scientific Times Square." (Independent review)
 - Visitors engage with objects, information, and environmental features
 - Even the galleries' lighting offer a way for visitors to interact with the Centre

- Visitors connect with Innovation Centre personnel who guide visitors as they participate in activities
 - "Hosts" (employees who are enthusiastic about science and teaching) are positioned throughout the Innovation Centre
 - They conduct live demonstrations and visitors can consult them for one-on-one guidance in activities
- Live field diaries offer another way for patrons to learn more about scientists and their research



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flickr, EffisCWC

National Museum of Natural History 63.

Peer Institution Profiles: Weston Family Innovation Centre at the Ontario Science Centre (cont.)

- Special events are organized specifically to provide teens with a connection to science in a casual atmosphere
 - SCI FRI (Science Friday) opens the Centre to teens during the evening for special activities and DJs
 - Part of the SCI FRI event is a Science Café, which presents discussion and information about relevant science issues
 - A Facebook advertisement for one Science Café read: “Look at your body in a new way! Don’t miss this chance to find out about new views on the human body. Ever considered donating your organs, or giving blood? Have you thought of the effect of the media on your own body image, or how it shapes what you think of other people’s bodies? Get into the discussion with our youth experts to find out about these issues and much more.”



SCI FRI's Science Café

Peer Institution Profiles: Oregon Museum of Science and Industry's “Science Pub” Program

- In 2007, the Oregon Museum of Science and Industry (OMSI) initiated its Science Pub program, in which experts talk about science in local Portland bars and microbreweries
 - The program was an immediate success that drew large crowds and OMSI has since sponsored the program in two other cities, as well as a second one in Portland; each location has a monthly Science Pub program
 - During the program, scientists give informal presentations and then hold a Q&A session at the end
 - Audience members are free to drop by when they wish, but the popularity of the program requires people to arrive early in order to get a seat
 - There is no admission fee or RSVP required
 - Although the bar setting is important in keeping the atmosphere casual (see page 67), the general model can also be adjusted and used for younger audiences
 - For instance, public schools in Oregon have also created “Science Cafés” for teenage audiences
- Other science museums have also begun using OMSI's Science Pub model
 - Recently, the Franklin Institute of Science in Philadelphia began its own “Pub Science” program in which small groups of science experts engage patrons of neighborhood bars in unscripted, one-on-one conversations about science



Example of OMSI's Science Pub logo printed on disposable beer coasters that are distributed at the events

Peer Institution Profiles: Oregon Museum of Science and Industry's "Science Pub" Program (cont.)

- The programs make science—and scientists—understandable to broad audiences
 - The experts wear casual clothing
 - Alternatively, creators of Franklin's Pub Science program note that their experts dress in traditional white lab coats to draw attention and set themselves apart from other bar patrons
 - The speakers use conversational language to explain complex issues
 - “[The speaker] managed to do what I, up to that point, didn't think was possible. He made the subject of Nanotechnology interesting and understandable.” (Independent blog)
 - The program often focuses on topics that are timely or have some pop culture relevance, such as forensic science
 - The format provides scientists with the opportunity to share their love of science with people who don't normally consider themselves knowledgeable about—or even particularly interested in—science
 - In one independent blog, for example, the reviewer notes that he usually doesn't go to OMSI (or science lectures, for that matter), but that the availability of good beer drew him in
 - “[This program shows that] science is for everyone; it's not something just people in ivory towers do.” (Interview from a media review)



Peer Institution Profiles: Oregon Museum of Science and Industry's "Science Pub" Program (cont.)



- Locating these programs in bars is key to instilling a comfortable but unique vibe
 - Participants recognize bars (or restaurants in some cases) as familiar, fun, informal, and low-key places
 - “Your friends are here. There's also pizza and beer.” (Interview from a media review)
 - They're pleasantly surprised to hear that science is reaching out in this way and happy to talk about science topics in the bars
 - “This brings science to the people instead of it being on a pedestal.” (Interview from a media review)



Peer Institution Profiles:

Jamestown Settlement and Colonial Williamsburg

- In Williamsburg, Virginia, two living history sites interpret American history
 - Both sites began as historic restoration initiatives in the first half of the twentieth century, with the goal of facilitating education about the origins of U.S. history
 - Today, these sites thrive as destinations for thousands of visitors—many of whom visit in conjunction with school fieldtrips or family vacations
 - Additionally, archaeological and historic research is still underway in portions of these sites
- The sites offer a variety of modes of interpretation
 - There are authentic objects and structures as well as life-size reconstructions
 - These are often displayed in a traditional exhibit format with interpretive labels
 - There are also live interpreters who speak with visitors one-on-one or in small groups, as well as organized reenactments of historic moments, such as battles



- Living history sites immerse visitors in a historic “moment”
 - Visitors are surrounded by sights, sounds, and smells that evoke a particular time in history
 - Interpreters maintain historic personas and use historically-accurate language and tools
 - Visitors can participate actively by “dressing the part” of historic figures



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National Museum of Natural History 68.

Peer Institution Profiles:

Jamestown Settlement and Colonial Williamsburg (cont.)

- These immersive strategies help living history sites to create “authentic” experiences
 - Visitors value this even though they recognize that some aspects of the experience are simulated
 - “I was afraid this would be a bit Disney-ish, but definitely not. You can truly get a sense of the history. It doesn't really matter that this wasn't the exact ground that Jamestown was on...since all we can hope for, in any case, is a feel for the conditions these settlers experienced.” (Independent review)
 - However, some note a distinction between these history sites and the “real thing”: nearby Jamestown Island (where Historic Jamestowne lies) is preferable to them

- Some aspects of these living history sites can seem messy to visitors—but these “de-sanitized” details are appreciated because they render the experience more genuine

- At Williamsburg, horse droppings lie where they fall in the street, and the butcher demonstrates how pigs were butchered



- Even though the live interpreters are actors, they do “real” work as it was done in revolutionary and colonial times...
 - For example, the seamstresses make dresses and blacksmiths forge nails, tools, etc.
 - They use historically accurate materials and techniques
- ...and visitors can choose to participate in this work to get a hands-on feel for how it was done
 - Interpreters ask them for assistance during demonstrations



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National Museum of Natural History 69.

Peer Institution Profiles:

Jamestown Settlement and Colonial Williamsburg (cont.)

- Live interpreters engage visitors in open-ended conversation
 - The live interpreters often entertain visitors in their interactions with them by engaging them in conversation and pointing out the merits of historic methods of working
 - This makes the information more interesting for visitors
 - *"An Englishman on one of the ships and a guide we met weaving a fish net as well as a woman carving a canoe were excellent. We could have talked to them for a long while. Very knowledgeable and interesting!" (Independent review)*
 - Visitors can shape the dialogue to fit their own interests
 - They can ask questions about any topic



An independent reviewer of Williamsburg commented on her photo: "A 'slave' helps my son with his courtesy."

- To visitors, these encounters feel pleasantly informal
 - Interpreters can also incorporate impromptu demonstrations into their interactions with visitors without making visitors feel compelled to participate
- Since the conversations are open-ended, they often lead visitors toward unexpected topics
 - It is often rewarding for visitors to encounter new information this way
 - *"We had several terrific conversations. One in particular, about the dual paths our nation has followed as a result of the different goals of the Jamestown and Plymouth colonists, was insightful and has stayed with me." (Independent review)*

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National Museum of Natural History 70.

Peer Institution Profiles:

The World Science Festival

- Since May 2008, New York City has hosted the annual World Science Festival, a one-week which includes a series of lectures and presentations and a sprawling street fair with hundreds of booths, activities, and demonstrations
 - Popular science book author and Columbia University physicist Brian Greene masterminded the festival with his wife, Tracy Day, an Emmy Award-winning television journalist
 - Events are held at major venues throughout the city, including the campuses of Columbia University and New York University, in addition to cultural institutions like the Metropolitan Museum of Art
 - The festival gained immediate acclaim, and planners intend the 2010 festival to be bigger than the first iterations



Oliver Sachs delivers a keynote address

- The festival showcases "celebrity" scientists
 - Notable scientists like E.O. Wilson and Harold Varmus (along with leaders from other disciplines) headline lectures and panel discussions
 - The events with well-known scientists on the roster always sell out quickly
 - *"The panel members were enough to make this science nerd drool." (Independent media review)*
 - Despite their renown, scientists participate in lectures in a public-spirited way that makes them unintimidating
 - The format of many of the talks and panels encourages scientists to speak personally and from experience
 - While the big names help draw audiences in, the format makes the lesser-known experts enjoyable too

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None/Getty Images North America

National Museum of Natural History 71.

Peer Institution Profiles: The World Science Festival (cont.)

- The festival offers a variety of ways to engage with science, which means there is “something for everyone”

- While some events are successful in appealing to a lay audience, others take a more complex approach to somewhat esoteric subjects

- Such topics may be inaccessible to the average festival-goer, but provide an engaging challenge to more scientifically-knowledgeable patrons



- At the Street Fair, visitors see demonstrations and participate in experiments
 - The sheer volume of booths ensures that there is plenty to see and do
 - “Once we were done marveling at the robots we hit Washington Square South, which had a strip of booths from different shows and organizations, all of them offering some great hands-on science. Some of the highlights included making slime with the crew from Mad Science Kids and experiments from “How to Fossilize Your Hamster” with the team from New Scientist Magazine.” (Independent review)
 - The fair is appealing to both adults and children



Peer Institution Profiles: The World Science Festival (cont.)

- The festival emphasizes an interdisciplinary approach to relating about science

- Visual artists and musicians are conspicuous throughout the events
 - Particularly in the Street Fair, artists have a strong visual and aural impact
 - Novelists and philosophers participate in panel discussions

- The atmosphere is fun

- The “festival” truly is aptly named—the general tenor is celebratory and exuberant

- The Street Fair embodies these sentiments
- The festival begins with an opening gala, replete with music and performers

- There is an emphasis on experts who specialize in unconventional science work

- These non-traditional scientists conduct fun and unusual demonstrations



- Even non-scientists, such as Disney’s Imagineers, conduct “experiments”

Prototype exhibits for the Future Math Museum at the Street Fair



Cellist Yo-Yo Ma performs with dancers at the opening gala

Disney’s Imagineers at the opening gala

Peer Institution Profiles: The Eden Project

- The Eden Project is a sprawling 35-acre botanical garden housed in bubble-like “biomes” in Cornwall, England
 - The biomes are the largest greenhouses in the world and each represents a distinct ecological environment: the Rainforest Biome, the Mediterranean Biome, etc.
 - Built in an exhausted quarry, the Project uses science and nature to teach people about the world and, ultimately, their relationship to it
 - Sustainability and environmental awareness were key principles guiding the construction of the biomes—and continue as guiding principles of the Project’s ongoing maintenance
- A critical appeal of the Eden Project is its drama and spectacle
 - The sheer size of the biomes and the diversity of the plant life within is visually powerful
 - The tallest biome reaches approximately 300 feet
 - Designers incorporated site-specific art throughout the biomes



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Flickr, Zon Wheelock

National Museum of Natural History 74.

Peer Institution Profiles: The Eden Project (cont.)

- The Project immerses visitors in two ways—with information and with special environments
 - Brief yet informative placards are found everywhere—on plants, building structures, facilities—even food trays in the café
 - There are also exhibits in “The Core.” The Project’s education center
 - *“It gives enough information to stimulate people, but not so much as to send them to sleep.” (Independent blog)*
 - *“Eden doesn’t put anyone on the spot...it subtly feeds you ideas under your radar.” (Independent blog)*
 - Reviewers are ambivalent about the amount of messaging
 - Some people note that the volume of information is overwhelming and “preachy”
 - Other visitors feel that the message isn’t strong enough
 - *“It doesn’t challenge anyone.” (Independent blog)*



Exhibits in The Core



As visitors eat, they are surrounded by edible plants. Interestingly, they cannot eat the plants because there is not enough to accommodate the thousands who visit each year

- The biomes immerse visitors in climates from around the world

- There is great detail in each biome’s environment; they include a diversity of plants and building styles typical to the regions represented
- Each biome has a real climate, which includes true-to-life temperatures



A tray with a message from the cafe

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National Museum of Natural History 75.

Peer Institution Profiles:

The Eden Project (cont.)

- There are rare, exotic “objects” that visitors don’t ordinarily encounter
 - The biomes mimic some of the earth’s ecological systems—which is a rare opportunity for many visitors who otherwise may never experience those environments
 - “Probably the closest I’ll ever get to being in a real rainforest!” (Flickr comment)
 - There are plants, trees, and even some small animals from around the world
 - Many visitors are impressed with the unusual plant life



Peer Institution Profiles:

Corning Museum of Glass

- Based in Corning, New York, the Museum of Glass focuses on the art of glassmaking—as well as the science behind it
 - The museum houses a vast collection of historic and contemporary glass pieces
 - Each day, the museum hosts a variety of live demonstrations of glassmaking
 - Additionally, the museum brings itself to a wider audience through traveling programs that take glassmaking demonstrations on the road
- Visitors experience the process and science of glassmaking in a first-hand way
 - In demonstrations, visitors watch as glass workers create glass objects
 - As glass masters work with the materials, a knowledgeable host explains to the audience what the workers are doing,
 - The instructor talks about the science that informs glassmaking
 - The demonstration areas are set up so that approximately 20-50 people can sit and watch with clear views of the show
 - Visitors can also sign up for workshops in which they learn about and participate in glassmaking
 - During a session, participants work closely with instructors to produce a small glasswork, such as an ornament or flower
 - These workshops involve small groups of participants
 - Each workshop takes no more than several hours
 - Many of these programs take place outside of the museum walls
 - GlassLab is a mobile hot-glass studio in which glass masters are paired with high-profile designers to produce innovative glassworks in a festival-like atmosphere



Peer Institution Profiles:

Corning Museum of Glass (cont.)

- Because the glassmaking process itself is visually appealing and theatrical, the museum feels more exciting and dynamic than a standard collections-based museum
 - The glass masters are highly skilled and confident in their movements
 - They handle “dangerous” things, like open flames and molten materials
 - The result of the work is often dramatic
 - Finished pieces are visually appealing
 - Independent reviewers highly approve of demonstrations that include glass-breaking, which talk about glass’s limits
- Glassmaking is a novelty for most visitors
 - Visitors typically do not have opportunities to see how glass is made
 - The glassmaking process is interesting and surprising to most



Peer Institution Profiles:

Darwin Centre

- In September 2009, London’s Natural History Museum opened the Darwin Centre
 - The Centre serves as a storage and display space for the museum’s immense collection of 20 million natural specimens
 - The Centre also functions as a world-class research facility where scientists conduct research on the museum’s holdings
 - A point of interest in itself, the Centre’s structure—a giant white cocoon-like building—has been acclaimed by architectural critics



- Just as NMNH is hoping to do with the Learning Center, the Darwin Centre hopes to make visitors’ interactions with “real” scientists a critical component of the Darwin Centre experience
 - Visitors can talk to scientists through an intercom
 - Reportedly, the scientists requested this feature so as to avoid the “goldfish bowl effect”: they wanted visitors to be able to interact with, not just observe, them
- Interactive installations are focused on the scientists themselves
 - The Centre’s biologists narrate stories about their research and the collections in videos and talks
- This aspect of science is understandable and interesting for many visitors
 - “Scientists become real when you hear that the head of beetles...started writing to the museum about his favorite subject from the age of seven.” (Independent media review)
- In a small lecture hall setting, called the Attenborough Studio, scientists engage with visitors in question and answer sessions

Peer Institution Profiles: Darwin Centre (cont.)

- However, some visitors are hesitant about interacting with the scientists
 - They worry about scientists' ability to communicate
 - "Do the scientists need PR certification?" (*Independent blog*)
 - A few also wonder if the conversations will interfere with the real work being done by the scientists
 - However, it seems that many of these comments come not from direct experience, but rather from widely-held perceptions of scientists
- The Centre also attempts to highlight the process of scientific research
 - As they conduct research, scientists are literally on display through large windows in the laboratories



An interactive exhibit about identifying parts of an organism

- This approach makes the Centre's science work more transparent and accessible for visitors
 - "One of the things I really liked about the whole Darwin Centre was that it explained the practicalities of what scientists do, and the clear explanation the rather complicated process of DNA sequencing was a great example." (*Independent blog, emphasis added*)
- Many of the interactive exhibits focus not only on the scientific content, but also the work involved in it, such as classification and preserving specimens

Peer Institution Profiles: Darwin Centre (cont.)

- Through the Centre's NaturePlus program, onsite visitors can download exhibit information to use on their home computers
 - Each visitor is given a NaturePlus card with a unique code that can be swiped in various exhibits; participants later enter the code, which gives them access to the information that they gathered during their visit
 - In this way, patrons can "take the museum" with them when they leave
 - This is a good opportunity for people who may not have enough time to see everything during their visit, particularly adults with children
 - However, some reviewers were disappointed that the information they accessed at home merely replicated what they saw in the exhibit—it seems that they were hoping for an experience distinct from their onsite visit
 - Another reviewer also complained that the "swiping" became the primary goal for visitors who wanted to amass information "without actually seeing the exhibits"



The NaturePlus card, with its unique bar code that enables visitors to "swipe" information in exhibits and take it home with them

Peer Institution Profiles:

Dinosaur Digs with the Indianapolis Children's Museum

- Since the summer of 2009, the Indianapolis Children's Museum has organized digs in which families work with museum paleontologists at a real dig site
 - Each dig session lasts several days and takes place in a pre-arranged field site at the Ruth Mason Quarry in Faith, South Dakota
 - Participants stay in nearby lodging and travel to the site, where they spend the day working with paleontologists
 - In the event of bad weather, the group visits research facilities in the area, such as the Black Hills Institute of Geological Research in Rapid City
 - The museum has also designed similar digs for science teachers
 - Findings which are deemed significant by onsite paleontologists are sent to the lab at the Children's Museum for analysis



→ ICM's paleontology lab has worked on several high-profile discoveries, including a new genus of pachycephalosaur, which pre-teen attendees named "Dracorex hogwartsia"



- The digs provide participants with a unique opportunity to do "real" science work
 - After a tutorial at the beginning of the session, each person can participate in the various stages of the field research—surface collecting, digging, mapping, and preparing the findings for analysis
 - They use the same tools that the professional paleontologists use
 - Throughout, paleontologists from the museum work closely with participants

Peer Institution Profiles:

Dinosaur Digs with the Indianapolis Children's Museum (cont.)



- The digs also offers one-of-a-kind souvenirs for participants
 - Some objects, such as bone fragments, are not usable in the lab and are therefore given to the finders to take home
 - These souvenirs are unique to each participants' own experience on the dig
- Even after the dig has ended, participants can engage with the objects and scientists
 - Back at the Children's Museum's paleontology lab, visitors can watch scientists as they analyze the findings from the field
 - The lab also holds special workshops in which preparators work with visitors on preparing specimens for analysis

- Several months after the programs, the museum sponsors a "Dig Reunion" in which participants can see their finds up close and talk to the scientists who have been working on them

- The lab is part of a section of the museum called the Dinosphere, which also offers dramatized fossil displays, faux fossil digs, and interactive games

→ "My 7 year old enjoyed digging for dinosaur bones and my 12 year old enjoyed observing the preparation of the bones and casts for display. The staff was eager to engage them both in conversation about the dinosaurs and what they were doing." (Independent review)

- These encounters at the lab and with the scientists are a way for participants to extend the special experiences they had at the digs



Peer Institution Profiles: Radiolab

- Radiolab is a unique radio program that focuses on science topics, but presents them in an entertaining and informal way
 - Radiolab is produced by WNYC, New York City's NPR affiliate, and broadcast on roughly 100 NPR affiliates nationwide
 - It is also popular as a podcast
 - Hosts Jad Abumrad and Robert Krulwich investigate “big questions” in science by combining research and documentary reporting
 - For example, one show was about *Mortality: Is death a fact of life or a disease that can be cured (as some scientists claim)?*
 - Abumrad is a documentary journalist and Krulwich is a veteran science correspondent and journalist
- The show has “personality”—in terms of the personnel, content, and information—that is entertaining, accessible, and smart



Hosts Jad Abumrad and Robert Krulwich

- Abumrad and Krulwich approach the material in a highly personal way
 - They infuse their own thoughts, beliefs, and quirks into the dialogue
 - As a result, their personalities shape the tenor of the show, so that it includes silliness, irreverence, self-mocking, and curiosity
- The “big questions” they select for the show are universal (almost commonplace) topics, but their approach is unique—although science undergirds their approach, they also bring in other disciplines to enrich their understanding of the question at hand
- The hosts consult a variety of sources—some of which are traditional, while others are unconventional for a science show
 - In a single sequence, they might speak to a university-based researcher, then a rock band, then refer to a folk stories and legends

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National Museum of Natural History 84.

Peer Institution Profiles: Radiolab (cont.)

- Presenting science in an accessible—but not “dumb-downed”—way is central to this personality
 - The accessibility is, in large part, due to the authentic, complex relationship between Abumrad and Krulwich, who talk about science intelligently and engagingly without being pedantic
 - They focus on asking thoughtful questions rather than providing all of the answers
 - “Abumrad is no scientist. He’s an artist conversant in the language of science.” (*Independent media review*)
 - And the show encourages reporters and guests (including science experts) to use conversational language too
 - Mini audio experiments are used to demonstrate the question at hand
 - Sound is an important component of each show; for example, in a show about laughter a guest scientist played clips of different “types” of giggles, snickers, and chuckles
- Somewhat ironically, it’s the show’s high level of intentionality and detailed choreography that create its informal tone
 - Each show is highly edited into an artful, seamless stream of dialogue and information, which is a resource- and time-intensive process
 - Yet, the many sources of information—interchanges between hosts, interviews with experts, and sound bytes—come across as conversational and informal
 - This duality creates a rich and vivid experience for the listener



Jad Abumrad in production and editing

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National Museum of Natural History 85.

Peer Institution Profiles:

America's Test Kitchen



- America's Test Kitchen is a television program that features recipes, cooking techniques, ingredients, and products that have been tested to see how well they streamline the home cooking process
 - The show presents the results of items and techniques that have been tested in their studio kitchens
 - For example, they tested four time-saving recipes for Boston Baked Beans and subsequently reviewed the advantages and disadvantages of each one
 - The Test Kitchen emphasizes visual demonstration to engage viewers and teach them about food and cooking
 - Viewers appreciate the visual nature of the show
 - Some fans actually record their own "test kitchens" and post videos them on YouTube
- Many Test Kitchen episodes include "Food Science" segments, in which the host consults a food science expert about a component of the focal topic, such as the action of yeast in a bread-baking episode
 - The expert gives a mini-lesson that includes a scientific explanation of the chemistry involved in the question and a demonstration of how that concept applies to the food preparation
 - For example, the segment might provide an illustration of the chemical process that occurs when yeast mixes with water and sugar and then a comparison of dough in different stages of the rising process
 - The Food Science segments show the chemical processes at work in food preparation
 - Recent segments incorporate animated illustrations of what happens on a cellular level

Peer Institution Profiles:

America's Test Kitchen (cont.)

- The information and "findings" seem highly relevant to viewers
 - The Test Kitchen demystifies a daily aspect of life: food preparation
 - The focus is on recipes and ingredients that are common to most U.S. kitchens
 - The Test Kitchen tries to save viewers money and time—a universal concern—by showing that more expensive items are not always the most useful ones
 - In Food Science, the expert or host focuses on how viewers' understanding of the chemical processes at play can help them improve their cooking skills
 - After the science segment ends, the show returns to the Test Kitchen, where the science information is put to immediate use in the recipe or product being tested
 - The Food Science programs have the added benefit of pointing out to viewers that science is a part of their everyday lives since most people prepare food in their homes



Testing oven mitts on America's Test Kitchen

- The Food Science segments are brief and straightforward
 - Lasting only about three minutes each, they are a low time commitment
 - The host and food science expert discuss only what viewers need to know about the process: little to no time is spent on theory or science history

Peer Institution Profiles:

The Arena Spectacular

- Since 1999, The Arena Spectacular has traveled around the world to perform a dramatic “imagining” of events involving Cretaceous Period dinosaurs
 - The Arena Spectacular was inspired by the British Broadcasting Company’s popular paleontology show *Walking with Dinosaurs*
 - In each performance, a “paleontologist”—played by an actor—narrates a story about the history and behaviors of 15 different kinds of dinosaurs
 - The dinosaurs are controlled by humans from inside the costumes as well as remotely through a specially-designed computer system
- The Arena Spectacular immerses viewers in a one-of-a-kind environment
 - The immersive experience encourages viewers to use multiple senses—sight, hearing, and touch—as they experience the show
 - Audience members are able to touch some of the dinosaurs
 - Smaller dinosaurs, mostly controlled by the actor wearing the suit, interact with viewers who are seated close to the stage
 - The dinosaurs emit “realistic” and dramatic sounds
 - “The sounds made it very real!” (*Onsite interview at NMAH*)
- The set is designed to be a dramatic imagining of what a natural environment could have looked like millions of years ago
 - The set, complete with volcanoes, palm-like trees, and other illuminated vegetation, contributes to the overall sense of “being there”
 - > “You’d swear you have been transported millions of years into the past and are bearing witness to a prehistoric fight for survival.” (*Independent media review*)



Peer Institution Profiles:

The Arena Spectacular (cont.)



- The experience itself is perceived as unique
 - The experience approximates seeing “live dinosaurs”—in a way that seems more realistic, vivid, and immediate than television specials or genuine dinosaur fossils in a natural history museum
 - “You get this sense of awe about their size and might that no museum skeleton can ever evoke.” (*Independent media review*)
 - Because the dinosaurs are controlled by people, each show is unique and somewhat spontaneous
- The ability to touch—and be touched by—the dinosaurs incorporates responsiveness into the show
 - Since the dinosaurs are controlled by live actors, they are able to uniquely respond to the audience in each performance
 - Audience members can “pet” or interact with the dinosaurs as they would a household pet
 - This responsiveness renders the animals more life-like and makes the audience members feel a part of the show
 - The high level of production that goes into each show makes the performances seem natural and life-like
 - Extensive planning, design, and rehearsing ensures that the audience does not see errors or the technical, behind-the-scenes portion of the production
 - “This dinosaur is so amazingly lifelike.” (*Independent media review*)

Key Findings: Peer Best-Practices Review

Peer institution profiles

Summary of key concepts

Summary of key concepts: The atmosphere an organization creates is critical to serving its audience well

- What virtually all of these organizations provide to their audience is access to an environment or atmosphere that is distinctive, rare, or awe-inspiring
 - In some cases, the environment feels special because it provides an authentic sense of “being there” when the real “there” isn’t accessible
 - Living history sites and Arena Spectacular provide an artificial but realistic sense of being in another era
 - The faithful replications of far-away climates in the Eden Project’s biomes expose visitors to places they might not otherwise be able to experience
 - Other organizations provide “privileged” access to spaces where cutting-edge science actually happens
 - The fact that JPL is only open to the public during the Open House weekend enhances the sense that visitors are seeing or experiencing something they can’t generally access
 - The archeological digs organized by the Indianapolis Children’s Museum fully engage visitors in the research process by taking them outside of the museum and to an actual, working dig site
 - At the glass-making demonstrations at the Corning Museum of Glass, the inherent danger in glass-making (high temperatures, sharp objects) makes visitors feel like they’ve become insiders
 - In some cases, it’s the organization’s engaging personality or distinctive tone that the audience responds to
 - Radiolab’s quirky, informal, irreverent personality defies conventional wisdom about what a science program (or a public radio show, for that matter) should sound like
 - Many cases show the importance of being intentional and strategic about creating a personality — even if that personality is primarily about spontaneity and informality
 - Although Radiolab is all about presenting science in an informal way, the conversational tone is the result of a highly-produced, deeply considered process

Summary of key concepts: Experts and other staff work consciously to make the visitor's experience feel personal

- Though expert interactions are a major component of many of these organizations, the successful ones go beyond merely providing access to experts
 - Many offer opportunities for interactions that can be made personally meaningful to the customer/participant
 - Visitors get chances to ask their own questions of experts, as at the Jet Propulsion Lab's Open House or the Apple Store, which makes for an experience that is visitor-defined rather than institution-defined
 - The dialogue between experts and the audience is casual and conversational
 - Opportunities to hear personal anecdotes or entertaining stories about scientific discovery are valued above lectures or an expert's recitation of facts; Science Pub excels at providing such informality
- Several organizations offer their audiences specific tools to help customize and mold the experience to suit their unique needs and interests
 - Many use a "host" or "concierge" model in which staff members assess visitors' desires and goals then guide them to the experiences that will best serve those
 - Including the Apple Store and the Weston Family Innovation Centre
 - Other organizations accomplish this by offering *many* activities pitched at a variety of skill or knowledge levels and then letting visitors self-select into the activities that suit them
 - For instance, the World Science Festival

Summary of key concepts: Drawing on other disciplines heightens the relevance of science to a broader audience

- Interdisciplinary or multi-disciplinary approaches are incorporated by many of these organizations to make science both more compelling and more relevant to the audience
 - This can be done by incorporating science into a nominally non-science subject — and then illuminating how an understanding of science can bolster the connection to that other subject
 - As with how America's Test Kitchen uses its Science Segments to make its viewers better cooks; cooking is the primary goal, but science is marshaled to serve that goal
 - It can also be accomplished by using the theories, insights, or tools of other disciplines to augment the experience with (and teaching of) science
 - The Weston Family Innovation Centre uses art and aesthetics to make science more vivid and more immersive
 - The World Science Festival and Radiolab both draw on a variety of disciplines to make science accessible and interesting to a broader audience

Appendix

Interview Guide

National Museum of Natural History
Learning Center Front-End Evaluation
One-on-One Interviews – Interview Guide

INTRODUCTION

[To be defined in pre-testing.]

INTERVIEW

1. Sometimes people get to go behind the scenes and see how things are made or done, meet the people who make things happen, and have a look at their equipment and the tools they use. If you could go for a behind-the-scenes-look anywhere, here in Washington or really anywhere in the world, where would you pick to go?

[Only if necessary, give examples of what we are referring to; stress that it doesn't have to exist currently.]

What would you hope to see and do there?

Who would you hope to meet, and what would you talk about with them?

How would that experience change your experience with the thing itself?

A. Have you ever had a behind-the-scenes look?

Where was it?

What did you like about it?

What did it do for you?

2. Here's a deck of cards with some of the things you might be able to do to explore science and the natural world. Please sort them onto this placemat in terms of how much each one appeals to you.

For each, discuss:

What do you like about it?

What do you like about:

Self-direction vs. expert guidance

Touching objects vs. observing objects

Observing fieldwork in person vs. live feed (where you can ask questions)

Scientist vs. other kind of researcher vs. other kind of museum staff

How likely are you to actually do this if available? What would make you more likely?

What puts you off about it?

What would/could make you more interested in it?

A. How about what's missing from these cards?

Can you think of other ways you could touch and even play with science objects to explore the natural world?

How about other ways of meeting and talking with scientists?

Interviewer _____

Date _____

Time _____ to _____

Location _____

3. Imagine a space here where you could go and explore science and the natural world in the ways that we've been talking about. It would be a room bigger than this one, and full of all sorts of objects and activities that would interest and excite you.

- What should that space be like?*
- What activities would be in there?*
- What museum objects would you put in that space?*
- What kind of experts would be there and how would you interact with them?*
- What one piece of advice would you most like to give them about such a place for discovery?*

4. We have some background questions to help us put your answers into perspective. Please start with the youngest person here and then go up by age.

Question	Youngest	Next	Next	Oldest
A. Gender <i>(Don't ask, just circle)</i>	M F	M F	M F	M F
B. What's your age?				
C. Counting this one, how many times have you been to this museum?				
D. What's the highest level of education you completed? <i>(check one)</i>	<input type="checkbox"/> High school, GED or less <input type="checkbox"/> Some college or college degree <input type="checkbox"/> Some graduate work or degree	<input type="checkbox"/> High school, GED or less <input type="checkbox"/> Some college or college degree <input type="checkbox"/> Some graduate work or degree	<input type="checkbox"/> High school, GED or less <input type="checkbox"/> Some college or college degree <input type="checkbox"/> Some graduate work or degree	<input type="checkbox"/> High school, GED or less <input type="checkbox"/> Some college or college degree <input type="checkbox"/> Some graduate work or degree
E. Which of the following best describes you? <i>(check one)</i>	<input type="checkbox"/> African American / Black <input type="checkbox"/> Caucasian / White <input type="checkbox"/> Latino <input type="checkbox"/> Other	<input type="checkbox"/> African American / Black <input type="checkbox"/> Caucasian / White <input type="checkbox"/> Latino <input type="checkbox"/> Other	<input type="checkbox"/> African American / Black <input type="checkbox"/> Caucasian / White <input type="checkbox"/> Latino <input type="checkbox"/> Other	<input type="checkbox"/> African American / Black <input type="checkbox"/> Caucasian / White <input type="checkbox"/> Latino <input type="checkbox"/> Other
F. Where do you live? <i>(city or state)</i>		<i>[or same]</i>	<i>[or same]</i>	<i>[or same]</i>
H. What other Smithsonian museums have you been to: [TOURISTS]: in this visit to DC? [LOCALS]: in the last year?				

5. We may have some follow-up questions to ask you based on your comments, or to show you some exhibit options we're considering and get your reaction. What's the best email address to send that to?

SUPPLEMENTAL QUESTIONS TO ASK IF TIME PERMITS

S1. How does what you see, touch, and do here relate to the world outside the museum?

- Is it more an escape from the "real world," a way to understand it better, or something else?*
- Do visits to museums change the way you feel about science?*
- What could the museum do to make what you find here more relevant to (your home/your workplace/your school)?*
- How could the museum, through its exhibits and its staff, make a bigger difference back home? In your neighborhood? In the world?*

S2. What have you enjoyed most about your visit(s) to the museum (so far)? What did you like about that?

- Can you think of other ways you (all) could get involved with what's available here at the museum?*
- How can the museum do the absolute best job of educating you? Of making your visit really interesting and entertaining?*
- What's your all-time favorite museum? What do you like best about it?*

S3. What words come to your mind when you hear the word "scientist?" Just off the top of your head.

- What do they look like?*
- What do they talk like?*
- What do they do?*
- Who have you met that is a scientist or most like one?*
- What did you like and not like about that person?*
- Do scientists do things that affect (each of) you?*

S4. How familiar are you with the scientists that work here at the museum?

- Based on what you know (or imagine), what do they do?*





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