CONFERENCE ARTICLE

One Hundred Strong: A Colloquium on Transforming Natural History Museums in the Twenty-first Century

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Abstract In February 2012, the Smithsonian's National Museum of Natural History (NMNH) convened 100 colleagues from 43 organizations to initiate a collaborative learning research agenda focused on examining important areas for innovation to better serve twenty-first-century audiences. The conference organizers anticipated that scientists, educators, exhibit professionals, and other members of the natural history community would identify and prioritize research questions about what, how, why, when, and where people learn about natural history. We prepared to engage in a conversation about how natural history museums *could* change what they *do*. The participants' overwhelming passion for their work, and for natural history museums and their transformative potential for society, quickly turned the conversation toward how natural history museums *should* change what they *are*. The result was an emergent learning research agenda situated within a broader vision for natural history museums.

Exploring, documenting, and communicating the history of Earth and its biodiversity and cultures has been the essential work of natural history museums for over a century. These tasks have taken on new urgency recently. The nearly one billion biological, anthropological, and geological specimens held by natural history museums enable critical research that addresses scientific and social priorities unforeseen a hundred years ago: rapid climate change; the challenges of providing energy, food, and water to an exponentially growing population; the rapid loss of global cultural diversity and language; and the increasing pollution and deterioration of natural resources such as coral reefs (Hennes 2007; NMNH 2011). The relevance of natural history collections is expanding apace with these challenges. The advent of new scientific technologies, such as scanning electron microscopy and genetic and genomic analyses, allow the extraction of more and different evidence of the intersections between human activity and the health of the planet.

Scientific research of the type that occurs in natural history museums is well aligned with the expectations of twenty-first-century audiences for experiences that are authentic, relevant, personalized, one-of-a-kind, surprising, and dynamic (Slover-Linett Strategies 2009). There is *dynamic adventure* in field work that studies nature and collects specimens. The questions being addressed about global change, invasive species, ecosystem changes, and dozens of other areas of research are *highly relevant* to people individually, as well as to their social systems, communities, and society. The study of objects and collections—holding, manipulating, and looking deeply at them—creates a *visceral connection* that helps to ground abstract, complex problems in tangible realities. The questions

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that can be asked of millions of objects taken together are nearly infinite, making natural history science *highly customizable* for imagining new questions. And collections themselves—millions of preserved animals, fossils, rocks, minerals, plants, and cultural artifacts—are unique assets that *provide new perspectives* on nature, its beauty, and its complexity.

Most natural history museums have just begun to meaningfully link their "behind the scenes" work with public experiences. Visitors are usually physically separated from the vast majority of museums' assets and disconnected from the relevance and excitement of the work. Because of this disconnect, natural history museums risk being perceived by the communities they serve as having limited potential to meet leisure and learning needs, and limited relevance for the world. Decreased relevance could lead to decreased attendance, reduced public support, and fewer resources to conduct critical research, resulting in lost opportunities to understand Earth's history and to address today's scientific challenges.

There is a concurrent risk of losing an enormous opportunity for public good that could be enabled by leveraging the scientific work of natural history museums for public understanding of, engagement with, and participation in science and in critical questions about Earth and life on it at a time when public awareness and understanding of those questions are becoming increasingly important (Hennes 2007). The untapped knowledge held by natural history museum collections and communities could become inert without new communication and engagement strategies that simultaneously and synergistically satisfy twenty-first-century audiences' needs and invite them into a more comprehensive and energetic (and urgent) dialogue about current scientific challenges and solutions.

In February 2012, the Smithsonian's National Museum of Natural History (NMNH) convened 100 colleagues from 43 organizations to begin a focused dialogue about strategies to address these risks. Our approach was to provide opportunities for the scientists, educators, exhibit professionals, and other members of the natural history community who attended the conference to share current approaches and ask questions about how best to leverage natural history museum assets for public understanding, engagement, and participation. The outcome we sought was a learning research agenda, broadly defined as an organized set of high priority questions to be addressed collaboratively. We reasoned that conducting research about the "who, what, where, when, why, and how" of learning with natural history museum assets could provide a focus for collaborative efforts, a foundation for research-based innovations that build on one another, and one avenue for innovating new ways to link natural history museum assets and audiences.

We prepared for a conversation about how natural history museums *could* change what they *do*. The overwhelming passion of the participants for their work and for the transformative potential of natural history museums quickly turned the conversation toward how natural history museums *should* change what they *are*. "Learning research" was a new term for many of the participants. In the context of mostly unstructured conversations, the exploration of what learning research is and how it can help natural history museums prompted discussions about what natural history museums really need for change. Those discussions led to dialogue about shared visions for natural history museums that superseded but encompassed the development of a learning research agenda that can and should be an important ingredient in changing how natural history museums engage with the public.

PLANNING THE CONFERENCE: WHAT WE THOUGHT WOULD HAPPEN

Theoretical Perspectives

Our planning was grounded in several observations: 1) Natural history museums individually and collectively represent multiple, often minimally overlapping communities of practice (Lave and Wenger 1991; Wenger 1998; Wenger and Snyder 2000). 2) Providing new experiences that more fully leverage collections, research, and public trust requires not only a change in offerings *for* the public, but a more fundamental change in relationships *with* the public. 3) Any changes in relationships with the public will first require changes in relationships within and between museums that foster learning communities focused on improving service to the public (Senge 1994).

One of the greatest challenges that natural history museums face in initiating and sustaining changes in public engagement is that they often do not operate as one community. Instead, they are aggregations of smaller communities. Within individual museums, the two large divisions—scientific communities, on the one hand; on the other, outreach, education, and exhibits communities—often have very different values and operating principles. For example, the education and exhibits communities increasingly value engagement in dialogue (McCallie et al. 2010), participation in authentic science (Bonney et al. 2010), and open access to museum collections. The scientific community values peer review and the rigors of scientific practice, which can preclude the involvement and often elude the understanding of non-scientists, including those who visit museums. The different traditions of each community can create tensions between colleagues within museums, and have historically made the two distinct communities—education and science—resistant to collaboration across museums as well.

The tensions are exacerbated by a lack of organizations engaged in community building and collaboration, such as are present in other fields (for instance, the Association of Zoos and Aquariums or American Alliance of Museums). There has been no ready mechanism through which to grapple with ways to reconcile or work within existing tensions. For the same reasons, it has been challenging to identify priorities for change and communicate progress toward changing practices. Innovations and promising practices have not been shared as efficiently or broadly as they might be, and new projects do not have the benefit of robust prior results as a foundation for new approaches.

Fostering Community

Our first strategy to foster community at the conference was therefore to reintroduce the various members of natural history communities to each other. We hoped to model the collaborations across traditional communities of practice that we argue are necessary to improve natural history museum practices. The group included scientists, educators, exhibit developers, administrators, collections managers, learning researchers, evaluators, and Web and new media specialists from 43 different organizations large and small: natural history museums, zoos, universities, science centers, and nature centers. Museum-based participants participated in pairs from an institution; one person represented the science endeavors of the museum and the other represented the public engagement aspect. Most participants could not remember a time when so diverse a group had assembled specifically to discuss the public presence and public value of natural history museums (Insight Evaluation Services 2012).

Our second strategy was to structure the conference around conversations among the participants. Two online discussions provided participants with opportunities to share their work and identify synergies before the conference started. Before the event, most participants met their opposite number—science staff, plus exhibits, education, and outreach staff—for discussions within their organizations. These intra-museum conferences were meant to consider both the future of the participants' museum and the general question of natural history museums as social institutions.

This set of strategies defined the final event. At the conference, participants spent three hours of each day in dialogue with 15 to 20 colleagues from different institutions and institution types representing different professions within the natural history community. The facilitated conversations allowed for ample opportunities to share and learn new perspectives on ideas and to grapple with the intersections of science research, learning research, and practice in exhibits, education, and outreach. Notes from the conversations were recorded live to the conference Wiki for conference participants and non-participants.

Learning Research as the Locus of Organizational Learning

A collaborative "learning research agenda" provided the mechanism to start the conversation about changing natural history museum practice. Learning research agendas have been proposed within the informal science education community as a mechanism for changing practice by building new theoretical foundations and innovations that advance understanding of, engagement in, and participation in science for all learners (Dierking, Ellenbogen, and Falk 2004; National Research Council 2010; Rennie, Feher, Dierking, and Falk 2003; Schauble, Leinhardt, and Martin 1997). A shared learning research agenda can provide focus for developing and testing new approaches, an empirical foundation for best practices, and a mechanism to synthesize the changes in audiences and organizational practices.

Schauble et al. described the importance of a learning research agenda that is shared by both researchers and practitioners: "[U]nless research and theory are brought into serious and sustained relationship with authentic practical problems, they threaten to become dangerously specialized, professionalized, and inbred… formulating and pursuing an agenda together are likely to foster growth in both [learning research and practice] communities if we can agree on a direction broad enough to be inclusive but focused enough to get somewhere together" (1997, 7). We argue that, for natural history museums, a learning research agenda should also include the scientific communities, because it should speak to how their members can learn to best leverage the assets they know so intimately for work about which they are incredibly passionate.

We introduced participants to a conception of learning which has been described by the National Research Council as a complex relationship among several "strands," including but not limited to motivation and excitement, explaining and using concepts, testing and predicting, reflecting, participating in scientific practices, and identifying with science (2010). This description of learning concerns itself with public learning in informal environments, but it parallels the daily actions of natural history museum scientists. It therefore encompasses an approach to learning that is valued by both scientists and educators, and that seemed particularly fitting for our purposes.

We also introduced a working definition for the learning research agenda we sought to develop:

> A learning research agenda is about asking and addressing excellent questions. A research agenda that informs practice is about really good questions that help that practice (in this case, of informal natural history education) to evolve and grow. Therefore, the learning research agenda should have at its heart a set of nested questions that, if answered, will help transform what natural history museums do for and with their publics—and how and why we do it. It will articulate high level, forward thinking questions and hypotheses about advancing the practices of public learning, engagement, participation, and education using the unique resources of natural history museums.

We reviewed several models for research that were either implicitly or explicitly identified as research agendas. They included the articulation of a vision statement with recommendations for building a field of informal science education research (Rennie et al. 2003) and a theoretically oriented agenda for understanding learning through a sociocultural lens (Schauble et al. 1997). We did not structure the conference dialogue around any one model, nor did we commit specifically to any one theoretical approach. We wanted to be as inclusive as possible about the field's interests and to find the learning research agenda model that best matched its needs.

Plan of Action: Structuring the Conference

Activities for the four-day conference were structured to encourage building community and establishing a shared learning research agenda. As noted, participants arrived having participated in two online discussions and having presented their visions for the future of natural history museums with colleagues at their home institutions. Day one was focused on activities for participants to get to know one another and to share the results of their conversations in small groups. The rest of the conference was dedicated to working sessions; six groups of 15 to 20 participants met to begin to identify the questions. We asked groups to consider the intersections between natural history assets and visitor demands and societal realities of the twenty-first century, with a focus on practice-oriented questions. Interspersed between meetings were inspiring keynote addresses, large group discussions, and social events aimed at provoking new ideas and continuing earlier conversations.

AT THE CONFERENCE: WHAT REALLY HAPPENED

Conference attendees defined the tone. Three themes that emerged almost immediately elevated the dialogue from practice-based changes and research questions to broader questions about the role and purpose of natural history museums in the twenty-first century. First, there was a sense of excitement about so many perspectives being brought together in the same room. By the end of the conference, 91 percent of participants would tell us that the greatest benefit of the conference was either the opportunity to network with people from other organizations and with different roles, or to gain new and different perspectives from others (Insight Evaluation Services 2012).

Second, there was a broadly shared commitment to and passion for the work of natural history museums and their potential for relevance in the twenty-first century. The commitment was evident from the first small and large group discussions on day one of the conference. The passion was stoked by two keynote addresses. Kirk Johnson, then chief curator and

vice president of Research at the Denver Museum of Nature and Science and now Sant Director of the Smithsonian's National Museum of Natural History, argued that natural history museums should be about something and could change the world. Scott Sampson, research curator at the Utah Museum of Natural History, presented an inspiring case for "putting nature back in natural history."

Third, there was little agreement on what was meant by a learning research agenda and more broadly about what was meant by learning. Defining the goal of a learning research agenda was more challenging than we anticipated. Two-thirds of participants did not identify themselves as learning researchers; they struggled to understand what a learning research agenda is, how it could be defined, and how it would help the field. Even those who did self-identify as such were uncertain about these questions. We expected this ambiguity and organized the working sessions in part to sidestep it.

Working sessions were designed to generate questions about how natural history museum assets could be used to address twenty-first-century audience expectations for engagement and participation. To start the conversation, session facilitators asked participants to 1) identify existing practices or suggest new ideas for public experiences in and with natural history museums that use one or more of the assets to meet one or more of the audience needs, and 2) identify questions that the field should address in order to successfully implement the new ideas. We expected that this way of proceeding would provoke specific, practical or theoretical ideas and questions.

Shared Identity

The participants decided that there were even bigger questions to ask. One of the working groups immediately tabled discussion of research questions and decided to focus exclusively on the shared vision that they believed was a necessary step in order to give direction to the research agenda. Their decision also shaped the course of the conference. The vision they articulated acted as an important counterpoint to the questions and concerns pursued by the other groups, reinforcing the feeling that the questions are worth asking and the issues worth pursuing. A portion of their initial draft is included here as a summary of the dialogue. (Original capitalization and punctuation are retained here.)

> The natural history institutions of the world affirm that: Humanity is embedded within nature and we are at a critical moment in the continuity of time; Our collections are the direct scientific evidence for evolution and the ecological interdependence of all living things; The human species is actively altering the Earth's natural processes and reducing its biodiversity; As the sentient cause of these impacts, we have the urgent responsibility to give voice to the Earth's immense story and to secure a sustainable future.
>
> We are places, people, collections, and facilities that connect the natural world and humanity in the past present and future. We are trusted and we are in the public trust.
>
> DISCOVERY: We make discoveries and create knowledge; We create new knowledge, collect, study; We are a collection of experts; Our collections continue to be global resources of knowledge.
>
> PRESERVATION: We are the keepers of the record; We are the places where our culture houses its treasures; We are a bank for information for the future; We are the archives of a changing world.
>
> AUDIENCE: We are learning institutions; We disseminate, inspire, and inform;

We tell the whole story; We connect art, science, nature, place and culture; We are a resource for people to take action; We are a meeting ground for science and culture; We are where children learn about the diversity of the natural world; We are places for public deliberation.

CREDIBILITY AND PUBLIC TRUST: We are owned by our public; We are trusted.

We recognize these tenets and our assets as the basis for a framework of collaboration and action: We will be places where the complex challenges of the future are met in an open, honest, inclusive, and rational way; We will be welcoming to all people, not just our traditional constituents; We will actively engage our assets, science, and stakeholders with local and global nature; We will be the storytellers of humanity's origins; the interface between humans and nature; We will reinvent ourselves to become trailheads for lifelong journeys of nature and science exploration; We will be agents of social change and embed people in nature by giving them new eyes with which to see the world and to understand their responsibility; We will work together; We will catalyze a sustainable future for the planet; We will do this before the end of the century.

This draft vision, informally called the "Declaration of Interdependence," captures some of the passion of conference attendees to fully commit to natural history museums as necessary members in a global effort to understand and sustain our world. The draft vision was also the locus of considerable debate. Some attendees were concerned that the vision recapitulated historical positions that focused on the museums, not on the publics they serve. Others were uncomfortable with the tone of advocacy; they debated whether the tone is appropriate for natural history museums as a whole, when the audiences they serve and the values of the communities in which they are embedded are so different.

We note that this vision is a draft, not vetted through the larger community of natural history museums or even by all of the conference participants. There was wide acknowledgement among conference attendees that this draft was a first step to start the conversation about what natural history museums should be, and that additional vetting through museum directors, boards of directors, colleagues from other museums, the communities they serve, and funders and policymakers—among others—is a necessary next step.

Learning Research Agenda and Organizational Change

The remaining working groups were influenced by drafts of this vision that were shared throughout the conference. The schedule we planned did not allow enough time for participants to articulate their passions and hopes and concerns about the future. The first of the three working sessions and much of the second therefore shifted focus from what natural history museums *could do* to what natural history museums *should be*. The working groups became a context for discussing shared challenges, opportunities, and values.

These influences ultimately enriched the ideas for a learning research agenda that emerged from the conference. The wide-ranging conversations within working groups covered topics such as existing innovative program models that could be researched or evaluated, as well as broad questions about if, when, and how objects and collections are helpful for learning about topics such as climate change, evolution, biodiversity, and world cultures. On the last day of the conference, those attendees who

self-identified as learning researchers or evaluators synthesized the questions and ideas articulated by the working groups into five high priority categories for learning research (summarized below):

Critical content. Critical content emerged as a necessary contextual factor for a learning research agenda. There was a priority for research concerned with how natural history museums can inspire learning that is urgently needed in order to understand and address current worldwide issues, particularly those related to sustainability, such as climate change, biodiversity loss, and evolution. "Critical content" also refers to processes authentic to natural history research, such as exploration of nature and scientific investigation not only of objects but also of collections. There was a strong call to frame research questions about other constructs (authenticity, mediation, and audience—see below) in the context of current topics with high relevance for individuals and society, because the field has much to learn about using its resources to address these topics.

Authenticity. Authenticity refers to a cluster of questions about the role of objects, collections, and data. These questions are at the heart of natural history museum scientific research. Concerns about what is "authentic"—and how much that matters—are becoming more important in a digital world. For example, natural history museums can now make millions of objects accessible digitally, yet we know very little about how and in what ways learning is affected when the objects of inquiry are digital and not physical. Representative, high level questions include: What is the role of the "real" (in terms of scientists, collections, and data)? What opportunities do physical objects and collections afford for learning about critical content? What opportunities do digital objects and collections afford? What kinds of participation in ongoing, collections-based natural history research (and not simulations of it) are possible in the time-limited setting of a museum visit?

Mediation. The group assigned the term "mediation" to a cluster of questions about learning with and across different platforms, including the Web, media, exhibitions, programs, and community-based outreach. Representative questions included: How can natural history museums effectively support digital media in a museum visit, and what outcomes are supported? Which ways of interacting with scientists, objects, or processes encourage new interest in and engagement with natural history? What kinds of experiences are effective at mediating experiences across settings (such as home, school, museums, nature)? How can design invite different forms of bodily engagement with and around objects?

Audience. There was widespread agreement about a need to 1) diversify audiences, 2) extend outreach to the non-visiting publics in the communities that natural history museums serve, and 3) study ways to expand audience ownership of and identity with museums. There are also important questions about what it means to identify with museums, how best to foster increased levels of engagement (McCallie et al. 2009) and participation (Bonney et al. 2010), and how to authentically reposition people who have traditionally been referred to as "audiences" in order to see them as members of the natural history museum community.

Organizational Change. Reorienting the perception and operating principles of natural history museums by including their publics and

breaking down traditional inter- and intra-museum barriers will require substantial organizational change. Therefore, the entire enterprise of learning research in any of these areas or their overlap must exist in the context of simultaneous efforts to transform organizations so that they support such research and its influence on changes in practice. Examples of high level themes for investigation and further discussion include: How can natural history museums partner with other organizations in ways that increase the coherence and richness of the learning ecology for learners who move between our physical settings? Who are our museums organized to serve? What organizational structures are needed to reach a broader audience and offer opportunities for engagement and participation? Questions about organizational change should be focused on how the field can work together to create the kinds of organizations that the draft vision articulated at the conference.

These categories were developed by a group of natural history scientists, practitioners, and learning researchers specifically because they are important to the broader field while simultaneously meeting the specific needs of natural history museums and their partners. We argue that the greatest opportunity to pursue research related to these topics lies in the points where they all intersect. Questions at the center of this model could define large-scale issues for the field to address; these issues could then be articulated as individual research questions by specific museums or research projects.

An example of a large-scale question could be: How can natural history museums best encourage use of (*mediation*) their collections and research (*authenticity*) to engage the next generation of citizen-minded scientists and science-minded citizens (*audience*) in taking ownership for solutions to global climate change that threatens human civilizations (*critical content*)? An individual museum or research team might then translate this question into a research program designed around a more focused, but related question, such as: What role do peer-generated (*audience*) digital comments (*mediation*) about climate change data (*authenticity*) play in increasing student awareness of how human activity is influencing Earth's climate (*critical content*)? Another might ask, How can data-rich (*authenticity*) conversations exploring (*mediation*) the effects of sea level rise (*critical content*) in an oceanfront community (*audience*) inspire action to mediate its effects?

These examples illustrate what learning research might look like within this emerging agenda. Each example could be broadened or made more specific, and could be explored by a collaboration of museums and other partners through either short, focused, action-oriented research or a longer program of focused, theory-building research. The purpose is not to prescribe research, but rather to suggest the areas of greatest need if natural history museums are to transform who they are, who they are for, and what they do. The process of synthesizing and vetting specific large-scale research themes from the hundreds of ideas shared by conference participants is an ongoing and critical step in continuing to build a new community of practice around the common task of conducting, sharing, and learning collaboratively from learning research in and about natural history museums. The emerging learning research agenda, when fully developed, will provide an expansive framework—theoretically compelling and important for practice—to allow for research on the innovations necessary to transform natural history museum practice, and to provide a focus for collaborations aimed at enhancing public value.

CONCLUSIONS

Natural history museums are in the midst of an unprecedented opportunity for linking collections-based research with the experiences they offer to the millions of people they are serving each year. If they are successful in fully integrating these two historically separate realities, they have enormous potential to elevate the public understanding of, engagement with, and participation in urgent and compelling scientific challenges now and in the future.

The effort will require much work to break down traditional barriers within and between natural history museums. The existing natural history communities must continue to learn how to invite broader and deeper participation by engaging the public, re-establishing themselves as welcoming communities for honest dialogue, and becoming "trailheads for lifelong journeys of nature and science exploration." Changing a century of tradition and integrating multiple communities of practice to establish a collective natural history museum community is a long-term goal that will require ambitious, courageous leadership. Changing one organization's culture is one of the most difficult leadership challenges to undertake. Establishing a common culture across hundreds of institutions with long-standing histories is orders of magnitude more difficult.

The Twenty-first Century Learning in Natural History Settings conference proposed what will likely be many strategies for organizational transformation. Our focus was not on change management, but rather on taking a first step toward getting different communities of practice to talk to each other and focus their work around a shared learning research agenda. Our expected result was that together these communities would begin to change some aspects of their practice to enhance their effectiveness at using the research and collections of natural history museums to engage and involve their audiences in new ways.

The conference produced a framework for a learning research agenda through a deeper, more committed dialogue than we expected. The vision provides an articulation of the aspirations that a learning research agenda can provide a path to achieve. We remain committed to the hypothesis that a shared learning research agenda is an important component of a multifaceted approach to natural history museums' evolution into organizations that fully realize their public value.

The Twenty-first Century Learning in Natural History Settings Conference that was convened by the Smithsonian's National Museum of Natural History was a first step toward developing a shared vision and learning research agenda for natural history museums. We look forward to making progress toward fully integrating scientific assets and public engagement as natural history museums build communities that transform these institutions for the twenty-first century.

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