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A Framework for Organizing a Cumulative Research Agenda in Informal Learning Contexts

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For the past half-century, museums, zoos, botanical gardens, and historical reconstructions have been deliberately fashioning a change in their institutional identities. These institutions have been shifting from a singularly inward-looking role as repositories for the display of valued objects, organisms, or artifacts, toward a multifaceted, outward-looking role as hosts who invite visitors inside to wonder, encounter, and learn. Although this shift has been under way for many years, and in spite of the sustained and persistent efforts of a few committed researchers from both the museum and university communities, a field of research on informal learning in museums has not yet cohered.

This lack of coherence exists in part because of an overriding concern in museums with the evaluation functions of research—an understandable concern, but not one that has been grounded in theory or motivated by the goal of constructing a cumulative knowledge base. The lack of coherence is exacerbated by the fact that the learning research community has until recently paid scant attention to informal contexts. The inattention persists because researchers in psychology and education tend to work from assumptions and methods originally developed to explore learning in laboratories and schools. These assumptions and methods are often inadequate for the very different learning challenges and opportunities in museums. For example, museums do not, by and large, aim exclusively or even primarily for improvement on measures of subject matter knowledge but instead tend to emphasize wider goals better captured by terms like enculturation, development, attitude, and socialization. In a museum, each visitor’s “treatment” is unique, because museums afford choice and variability in learning rather than mastery of a common curriculum. Moreover, learning effects of a museum visit may have a very long “cycle time,” sometimes emerging years after the encounter occurs. These features make museum learning very difficult to track with the methods and approaches familiar to most researchers. Finally, for many learning researchers, the prototype of learning remains “school learning,” and museum learning does not fit this prototype very well.

Yet recently, it seems, there has been a steep increase in the number of fruitful collaborations that have sprung up between museum professionals and learning researchers working together to address these challenges. In the spirit of contributing to this newly blossoming exchange, we introduce here a theoretical framework for research on processes of learning in museums. The framework has been developed to organize the common work of members of the Museum Learning Collaborative (MLC), a partnership sponsored by the Institute of Museum and Library Services. The MLC serves as a common forum for researchers and practitioners interested in learning—broadly construed, to include all forms of meaningful personal change—in informal contexts. These environments span an array of domains, from art and history to natural history and science, and in the future, we expect this variability to grow. Members of the collaborative also work in a wide variety of contexts, including universities, art museums, history museums, children’s museums, science museums, zoos, historical reconstructions, arboretums, and botanical gardens.

The purpose of the partnership is to develop and then pursue together a research agenda that can support the development of a cumulative body of knowledge on museum learning, one that will build over time and become increasingly generative and generalizable. As it grows, such a knowledge base will transcend the concerns of museums to inspire new issues and questions about the nature of learning itself. To pursue such an agenda together, we need agreement on a broad but well-defined theoretical framework. Theory is essential to keep such an enterprise from spinning off into a mere collection of unrelated investigations, because theory highlights the questions and issues worthy of exploration, points to what is central in the research findings, and provides the integrating frame that serves to define a coherent portrait from a series of independent investigations.

Theoretical Approach: Socio-cultural Framework
After initial reflection, we concluded that the guiding theoretical framework
that could best organize our common research agenda is sociocultural theory. Sociocultural theory emphasizes that meaning emerges in the interplay between individuals acting in social contexts and the mediators—including tools, talk, activity structures, signs, and symbol systems—that are employed in those contexts. Individuals both shape and are shaped by these mediators. A unique aspect of humans is our propensity to invent with the instruments of our own development. In our view, this focus on mediators is a perspective that is very congenial to museums, which have long honored symbolic and cultural meanings, signs, and tools. This view also emphasizes the importance of culture, environment, and history in every learning context and every learning event. These general ideas are reflected in the work of both classical theorists (e.g., Luria 1976; Vygotsky 1978) and contemporary researchers in human learning (e.g., Carpenter and Lehrer in press; Cobb 1994; Lave and Wenger 1991; Wells, Chang, and Maher 1990).

Sociocultural theory suggests that understanding a phenomenon entails understanding its development. Thus, understanding learning means studying in detail how it unfolds. According to this perspective, human thinking is formed by the talk, tools, symbols, artifacts, histories, and activity structures that are in its milieu. Rather than explaining variability in learning primarily by positing differences in individuals’ propensities and talents, sociocultural theory turns our attention to questions such as: What kinds of activities are supported in this place? What forms of talk are expected? How do tools and symbols support forms of thinking that otherwise could not occur? These issues and questions are particularly fruitful for people—such as educators, exhibit designers, and teachers—who are interested not only in understanding learning but also in engineering productive forms of it.

These features of sociocultural theory imply three main ways in which it can guide learning research in museums toward questions or perspectives that are consistent with the unique nature of learning in these contexts. Specifically, this perspective throws light on the variability of learning, processes of learning, and the role of learning in personal history and the pursuit of meaning.

Sociocultural theory can span the wide variety of informal learning contexts that museums provide and their diverse populations of visitors. Unlike some other theories, it emphasizes the importance of accounting for variability as well as commonalities in visitors’ learning. Important forms of variability for study include the experience, knowledge, and interests that visitors bring to museums; the kinds of activities and pathways in which visitors engage during their visits; and the means by which museums contribute to their evolving ways of knowing and responding to the world.

Sociocultural theory focuses on processes of learning, not simply its outcomes. An exclusive concern with learning outcomes implicitly assumes that learning is a kind of “product” and that visitors are containers who carry that product out with them when they leave the museum. Such a metaphor is problematic, given contemporary theories of learning and given the overwhelming variability of what visitors engage with and do in museums. Matusov and Rogoff (1995) suggest that it may be fruitful instead to refocus our attention away from these “products” and toward characterizing the range of the forms and functions of visitors’ activity that takes place in museums. How can the learning activities that occur in these environments best be encouraged, fostered, and deepened so that they afford increasing levels of opportunity for future growth?

Third, sociocultural theory is developmental, in two different senses—in its methods for tracking change over time and in its emphasis on identifying the role of meaningful encounters and events in the sweep of a person’s life history, including investigation into how that meaning may shift at different points in the life span (e.g., Bates 1978). A developmental approach suggests the value of studying learning over a longer duration than the typical one-trial experiment; identifying relationships between visitors’ long-term interests and goals and the museum; and studying the role of important social units, such as peers, families, and communities, in an individual’s experiences with the museum.

The final criterion for a useful theory, one that winds through all three mentioned above, is that sociocultural theory foregrounds meaning, not just behavior. Museums are places of signs, symbols, culturally significant artifacts, tools, and activities. Learning entails meaning-making, and it is difficult to think of institutions that more self-consciously value this conceptualization of learning than museums. A focus on meaning highlights the multiplicity of forms of adaptiveness that are characteristic of individuals with widely varying environments, histories, and cultures. What counts as intelligent behavior depends on the mix of values and resources that the culture affords, so the origins of intelligence should be sought in social interaction rather than solely in the heads of individuals. Such a view emphasizes the social roots of cognition and draws attention to places like museums, where people come together in a public place to encounter objects, events, and symbols of particular cultural value.

Three Integrating Themes

This is obviously a very broad guiding theoretical foundation, and from it, we could presumably derive many “big issues” for study. To organize our work together and thus accelerate our progress in the initial years of our collaboration, the MLC partnership has decided to focus on three major integrating themes that follow from the framework. These are: (1) learning and learning environments; (2) interpretation, meaning, and explanation; and (3) identity, motivation, and interest. Our intent is to address each of these interrelated themes with a variety of studies that span different contexts and visitor populations. None of these themes is unknown to the museum community, and as we introduce each below, we
Design experiments are explicitly concerned with learning; hence, they emphasize the importance of grounding both the design and the research in issues fundamental to learning.

For example, the design of the Construction Site exhibit in the ScienceWorks Gallery at the Children’s Museum of Indianapolis was explicitly motivated by a series of studies on children’s understandings (and misunderstandings!) of simple machines (Lehrer and Schauble in press a and b; Metz 1991; Penner, Giles, Lehrer, and Schauble 1997; Penner, Lehrer, and Schauble in press; Schauble and Lehrer 1995). Collectively, these studies suggested that elementary school children often fail to see what is before their very eyes when they inspect devices that include gears, levers, and inclined planes. Instead, their expectations and interpretations tend to be driven by familiar mental schemes about the way things usually work. For example, in the context of inspecting chains of gears on a gearboard, children often report that all the gears turn in the same direction, regardless of their configuration or relative size, because “Things move in the direction they are pushed and don’t move any faster than the thing that pushes them.” The purpose for the Construction Site was to provide an environment in which children’s extended symbolic play (at being construction workers who operate bulldozers, dump trucks, and giant cranes) would bring them into contact with the need to take actions that highlight important ideas about machines. These might include, for example, negotiating trade-offs between distance and effort in driving wheelbarrows filled with foam “rock” to a dump site over alternative ramps (one steep but short, another shallow but long), or transforming motion through hand levers to giant wheels to move a heavy bulldozer (Schauble and Bartlett 1997).

Interpretation, Meaning, and Explanation
The second major DLC theme emphasizes interpretation, meaning, and explanation as processes and products of social interaction in museums. This theme presses on the issue of dialectics among curator, institution, and viewer, and acknowledges that meaning is inherently social. Museums are places of dialogues. There are implicit dialogues between the display or art object and the viewer, and explicit dialogues between the curator/designer and the
viewer/participant, or between docents and multiple participants. These dialogues may range in explicitness from mood or hint to detailed explanation. For example, contrast an exhibit of an Egyptian mummy that is carefully designed to elicit a mood of reverence and respect with an interpretive live animal show featuring local snakes and explaining facts about their growth, eating habits, and reproduction to a group of assembled visitors. Of course, even when visitors come “alone” to informal learning contexts, this dialectic quality is ever present, as the visitor interacts with the meanings and intentions of the exhibit “author.” Dialogues also reflect a range of directiveness, from mere invitations to respond internally to general suggestions that can be pursued in many ways, to invariant sequences of prescribed actions. How do visitors learn to participate in these many forms of dialogue? What happens when visitors’ expectations do not match those of the designers, and the conversation breaks down? For example, Siegel’s (in preparation) research explores how parents attempt to interpret analogic models in museum exhibits to their children and documents the breakdowns in learning that result when there are mismatches or incomplete matches between the objects and relations in the model and the objects and relations in the phenomenon being modeled. Within this general theme, then, we address the ways in which individuals and groups make sense of their experiences within the museum.

Under this theme, we also include investigations of the nature of intentions and social interactions among viewers, and between viewers and the museum. The agenda includes research on patterns of intergenerational, intragenerational, interviewer, and even intraviewer interactions that lead to interpretation. For example, a number of studies have analyzed how and whether social interactions in visiting family groups contribute to this interpretive process (Crowley and Callanan 1997; Leichter, Hensel, and Larsen 1989). Using a body of studies on the development of scientific reasoning as a foundation, Gleason (1997) studied parent-child dyads working together on an open-ended, self-directed scientific experimentation problem very much like the activities frequently featured in science and children’s museums. The findings revealed that parents worked actively and effectively to support their children’s experimentation strategies but also missed some important opportunities to assist in aspects of their children’s reasoning where they did not realize that children were experiencing difficulties. Identifying precisely where and how parents provided (or failed to provide) assistance gave specific clues for exhibit designers about just what parents needed to know to foster their children’s learning effectively in experimentation contexts.

Another kind of study that would fit within this theme is research that considers the intentionality of an art museum’s display of work and contrasts it with the typical visitor’s understanding of the features, problems, and goals of a particular artist. Research on explanations in a variety of learning and teaching situations suggests that to be effective, instructional explanations require an understanding of the query or problem being explained (Leinhardt 1993; Leinhardt and Schwarz 1997). However, the artist, the curator, and the visitor may well have quite different understandings of “problem” (Leinhardt and Young 1996). A naive visitor may feel that the main problem for an artist such as Wyeth or Homer is to paint a moving and representationally accurate picture. Further, the visitor may believe that the main purpose or intentionality of the curator is to show the picture in a way that makes it easily visible. The curator, in turn, may see the problem to be “explained” as one relating to the artist’s role in the larger sweep of artists of that time and place. So the curator may choose to explain this problem through arrangements that reflect the way in which the artist handled light or mass over time. Or the curator may wish to explain the technical difficulty that the artist dealt with in specific aspects of a painting by showing multiple sketches in several media of the “same” problem and its attempted “solutions.” Does the visitor’s sense of task and problem change as a result of these implicit and explicit explanations?

Identity, Motivation, and Interest

The final theme considers how museum experiences both depend upon and change the ways that people see themselves as learners of history, art, or science; as historians, artists, or scientists; and as members of cultural groups with a rich past and an open future. How and what people learn in museums are very much a function of their motivations (why they have come there), their interests (enduring propensities to engage with a topic), and their sense of identity (who they think they are in relation to museum offerings). Identity, motivation, and interest are closely interwoven in people’s behavior, although it may be helpful to analyze them separately in research.

Within this theme, one might consider the role of narrative in engaging interest. Many art and history museums use this technique dramatically, although research on its impact is not widely acknowledged. There is an issue about learning here that is deeper than the appeal and efficiency of the form. Cognitive research shows that, universally, people can mentally organize information effectively if it is recounted to them in a story (Mandler and Goodman 1982; Mandler, DeForest, Scribner, and Cole 1980). Even children learn and remember technical information if it is presented as integral to a compelling plot (Children’s Television Workshop 1993).

Researchers also recognize that people tell themselves stories about their experiences and that these stories knit the meaning and significance of events they encounter (Bruner 1990; Cortazzi 1993; Feldman, Bruner, Kalman, and Rendtorff 1993). For example, the Arizona Science Center’s preliminary work finds that many nonscientists have a very different view of the field than do scientists. In a sense, members of the lay public have very different personal stories about science, which may lead to barriers in their
understanding. Furthermore, the fact that the canonical organization of science is in models rather than narrative may also raise challenges to comprehension. To explore these issues, the Arizona Science Center, supported by the National Science Foundation, has been investigating the role of narrative in engaging the interests of diverse audiences. Four science-oriented stories about solar energy were written by Native American, African American, Hispanic, and feminist writers in collaboration with scientists and science writers. The stories, which have been tested for audience appeal, next will be made available under controlled conditions to people visiting the solar energy exhibits at the center. Visitors will be observed as they use the story material and interact with related exhibits, to track engagement level, verbalizations, and physical interaction. Recall and reasoning tests will be administered afterward, and follow-up phone interviews will examine the longer-term impact of the narratives on comprehension of and interest in the exhibit topic. Additional studies in this genre may examine the use of stories in other kinds of museums as well, including art and history museums.

These three themes, then—learning and learning environments; interpretation, meaning, and explanation; identity, motivation, and interest—summarize the thrust of our common agenda. Although some studies fit smoothly within one of these overarching themes, at least as many studies will cross their boundaries. For example, one can hardly imagine an effective learning environment that is not concerned with interpretation and visitor interest. In our view, these interconnections are important because they call attention to the relationships among learners and environments in the context of meaning-making. A comprehensive research program on informal learning would do well to focus explicitly on these interconnections and regard them as especially fruitful junctures for study.

Conclusion

A consistent challenge for informal learning contexts has been the need to establish that visitors learn—that is, show enduring changes in their knowl-

dge; their relationship to or attitudes about art, history, science, nature, or aerospace; and their willingness to make that relationship a long-term prospect, one that continues to deepen and change. However, this challenge has not been met successfully by simply importing the existing assumptions and methodologies of learning research. Yet learning research itself is changing. Many researchers are noting that unless research and theory are brought into serious and sustained relationship with authentic practical problems, they threaten to become dangerously specialized, professionalized, and inbred. Equally important, the wider the range of practical problems and environments in which researchers engage, the more likely it is that assumptions will be challenged in a healthy way, theories will be expanded and elaborated as they are required to do more "work," and formulations that are elegant but ungrounded will be weeded out. It follows that a healthy research community is one that engages a diverse set of complex environments. Thus, in our view, formulating and pursuing an agenda together are likely to foster growth in both communities if we can agree on a direction broad enough to be inclusive but focused enough to get us somewhere together.

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As an educational researcher and evaluator at the Exploratorium, I am often grappling with what learning is and how to measure it. In response to the article by Schauble, Leinhardt, and Martin, I asked myself: How would these ideas apply to my own work? Some of my thoughts are as follows:

1. The article emphasizes the "processes of learning, not simply outcomes." Taking this perspective, I would pay attention to the direct, moment-by-moment interactions of visitors with each other and with objects, rather than relying on summary interviews conducted at the end of an exhibit or exhibit element. One of the appealing things about such an emphasis is that it invites me to study learning when and where it happens, in all its full complexity. I can watch a real blend of teaching and learning, affect and cognition, individual and social activity, without having to filter it with a series of specific questions to an individual.

   Perhaps we can take this emphasis as encouragement to be professional people-watchers, both more often and in more sophisticated ways. For example, we can "zoom in" on visitors' learning processes by looking at their words, expressions, and gestures in great detail, or we can "zoom out" to get a more holistic view by following their activity patterns through an entire visit.

2. The research agenda focuses on learning as "meaning-making" rather than in terms of behavior. This distinction seems to me to be important. Unfortunately, since meaning is very personal, it is almost impossible to know what meaning is being constructed just by watching people's movements. If we embrace the central role of meaning-making in learning, then I think we must question the use of tracking and timing data in isolation because such data show where people spent their time, not what their experiences meant to them.

As an example from my own experience, there is an exhibit at the Exploratorium called "Suspense." Designed to show feedback operating in an electromagnetic system, it features a metal ball held suspended by a magnet. Observations of visitor behaviors were quite positive: visitors manipulated the ball and magnet successfully, stayed at the exhibit for extended periods, and
showed signs of excitement and pleasure. However, when we asked visitors what they thought the exhibit showed, many replied that it was a model of the solar system with the ball representing the earth. Without the opportunity to hear visitors’ own interpretations of their experience, we would never have realized the exhibit’s tendency to generate spurious meanings!

By presenting learning in terms of both process and meaning-making, this article brings home to me the value of doing two things in tandem: watching the detailed activities of visitors in museums, and listening to their interpretations of those activities.

3. The article describes museums as “places of dialogues,” including implicit dialogues where our exhibits and objects speak for us. To begin with, I take this characterization as a sobering reminder to keep our museum floors in excellent condition, because a neglected or poorly functioning exhibit tells visitors about us just as clearly as a working exhibit does. More broadly, though, it raises questions in my mind about how we present ourselves to visitors while we are implicitly “conversing” with them throughout their museum visit. Do we intend to come across as an all-knowing, objective authority? Would we rather take on multiple, diverse voices in our dialogue with visitors? I would like to study the effects of adding a new component to some of our exhibits in which we let the individual developer speak more explicitly to visitors about his or her intent through a written piece or a video clip.

4. The article proposes that researchers and practitioners engage in real collaboration, “pursuing an agenda together.” This proposal seems particularly important if we decide, as the authors suggest, to attempt studies that are iterative “design experiments.” Large-scale, iterative design is not a single-person endeavor. So I wonder: How can I encourage my colleagues to join in this kind of collaborative research agenda? I think the great majority of museum practitioners already have a personal commitment to visitor learning. However, there are many factors driving the development of exhibits, and research on learning is only one of them.

I believe that researchers and practitioners might come together around a common wish for a practical vision of what learning looks like and a common language for talking about it. Most of us are good at recognizing gross failures in our exhibits (such as no holding power or catastrophic failures in usability), but the subtleties of learning are much more difficult to recognize. As a way to start, I would like to invite interested museum colleagues to meet on a weekly basis to look at videotapes of visitors in the museum, at a range of exhibits. Video discussions are a powerful and underused technology for learning to “see” transient and subtle things in real-life settings. The group could be led (at least initially) by a professional researcher skilled in recognizing the nuances of learning in real situations, and different members of the group could talk about what they see as successful learning experiences on the museum floor. As well as being interesting, this activity would help us to clarify what it is we value in our museum and to start to build a useful vocabulary of things we could recognize as aspects of learning. For example, could we learn to recognize when visitors are explaining, asking, guiding, watching, recounting, experimenting, collaborating, reinterpreting, exploring, making connections, or drawing analogies? Could we see how aspects of our exhibits helped or hindered them as they did these things? If we started with the types of learning we really want visitors to engage in, then surely it would be worth our time to learn to recognize evidence for them.

5. Finally, the article discusses the power of narrative, and it encourages us to explore the impact of stories on visitors’ interest and motivation. I think this is a fascinating direction of study, and one that could also bring together researchers and museum practitioners. For example, we could encourage visitors to tell stories of their own, based on their relationship with the museum. We might ask visitors to make a short video of what they remember from their first visit, or what they expected before they came, or what happened during their current visit. Visitors might find it inspirational or comforting to hear someone else’s account of how he or she experienced the museum. Also, such narratives could be used in learning research, both as data in themselves and in terms of their impact on listeners. Visitors’ stories might be an excellent arena for bringing together the ideas of learning-as-process and learning-as-meaning-making.
Commentary

Research on Learning in Museums: Three Realities, an Example, and a Promise

ANN LEWIN-BENHAM

The Museum Learning Collaborative has the noble and important goal of guiding the formulation of a research agenda that will support the development of a cumulative body of knowledge on museum learning. The authors have served this purpose well in adopting sociocultural theory as the organizing framework and in focusing on three integrating themes. This response has two parts. The first part comments on the effort in terms of realities about the place museums occupy in our culture. These realities are: how different from one another various kinds of museums are in their missions, how disparate a museum's intent and its visitors' intent may be, and how wide a gulf there is among what the museum professional, a specialist, and the museum visitor, a layperson, think constitutes meaning. Regardless of how significant the research results may be, they will fly in the face of these realities. The second part extends the authors' ideas by recounting an example of a successful piece of research which exemplifies the kind that the MLC effort could evoke. The example describes the conditions under which the research took place and shows why such research holds promise for helping to realize the potential of museum exhibits to enhance learning.

Reality One: The Different Missions of Diverse Museums

By the mid-1950s, museums had become places whose role was to identify, collect, preserve, and present things representative of the natural and manmade worlds with an emphasis on collections. They differed in a wide range of ways, from environments and explanatory techniques to identity issues. That role was challenged by the rapid proliferation, beginning in the 1970s, of interactive science and technology centers and children's museums. These two kinds of museums emphasized learning as the prime mission and devised major new forms of explanatory techniques and innovative environments in filling that mission. One challenge to the research will lie in proposing hypotheses that transcend the differences among museums. A greater challenge will lie in undertaking research that could make these different places porous so what they do to support learning, in all their iterations, permeates other aspects of our culture.

Reality Two: The Gulf between the Intentions of a Museum and Those of Its Visitors

Regardless of their differences, most museums express their missions in terms of the impact they hope to have on their visitors. While the outcome of the research may, ultimately, modify those missions, the challenge will be to bring into correspondence the expectations of the museum and of its visitors. Where is the intersection between the museum's mission and the visitor who enters the museum to go to the bathroom? to buy a Christmas gift? to get into an air-conditioned space on a hot day? to sit down? to eat lunch? to check off an item on his "been there, done that" list? to amuse the children on "father's weekend"? In other words, what about those visitors whose agendas have no intersection with the museum's stated mission (given that "Improve Gift Shop and Cafeteria Sales" is not likely to be part of the mission statement)? Unless there is an intersection (We, museum, exist to educate / L, visitor, am here to learn), the research is not likely to have an impact. But, let's assume that there is a museum/visitor contract to educate/learn.

Reality Three: Different Views of Learning

There is a general notion in our culture that learning is hard work, that without effort, difficulty, and probably stress, we are not learning. The notion of joy and effortlessness is foreign to how we think about learning. Thus, the excitement and joy that some visitors experience in museums do not match most people's mental image of learning.

Moreover, the things visitors are most likely to learn in a museum are not the things in the school curriculum. Yet, the school curriculum has become the checklist for what most people think of as learning, especially for children. The curriculum for children includes reading, writing, arithmetic, history, geography, and, as they get older, science, geometry, calculus, and, maybe earlier.
or later, a foreign language. Art barely makes the cut. The museum subject matter is considerably broader and is framed entirely differently. The apparent disjunction between subject matter in museum exhibits and subjects in schools suggests to some people that museums are not relevant to learning.

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**An Example**

These realities aside, consider this example in the context of parents who take their children to a children’s museum because they hope the children will learn something. In the early 1990s the Please Touch Museum in Philadelphia had an experimental gallery where new exhibits were tried out. One exhibit attempted to teach the physics of falling objects by using two large cylinders, each wound with a transparent Flexiglas tube, and each tube at a markedly different angle of incline. The intent was for children to drop two balls simultaneously, one into each tube, to notice the effect of the different inclines and to draw a conclusion about the relation between angle and the rate at which the balls dropped through the tubes.

In fact, few children did anything other than shove one ball backward up a tube a foot or so. Experiments with a variety of instructional signs, diagrams, and docent scripts yielded almost no change in visitor behavior. Finally, the research team hit upon the idea of adding video instruction, a simple short clip showing two people, each simultaneously dropping a ball into one of the tubes, noticing the result, and describing it. Bingo! Visitors began to imitate the behavior on the video, to look for the effect, to question the outcomes—in other words, to engage in the experiment as it was designed and to question results as a scientist might.

The museum, through research, had devised an effective way to mediate a visitor’s experience, and visitors, the researchers found, were engaging in dialogue about a scientific phenomenon, about cooperation with someone toward a particular end, and about conducting an experiment. Moreover, they were learning about the physics of rolling objects. The researcher was Rochel Gelman, then professor of psychology at the University of Pennsyl-

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**A Promise**

If the proposed M.I.C.-orchestrated research can replicate these conditions in a wide enough range of museums, the results promise to be rich for museums and their visitors. Moreover, the results could ultimately, as the authors propose, “transcend the concerns of museums to inspire new issues and questions about the nature of learning itself.”

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**FURTHER READING**


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