

Exhibitions as a Context for Engaging Young Children and Families with the Ideas that Technology Can Reveal

by Diane Willow

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Technology in museum exhibitions for young children and families often signifies computers. In the context of these reflections, the technologies I discuss range the spectrum from tangible tools to digital technologies. I have taken inspiration from a comment made by physicist Philip Morrison, illuminated recently by researcher and science educator Karen Worth (2005): “Science is not itself the world; rather it is one reaction to it.” My reflections on technology are rooted in a similar perspective, that technology is not itself the world, rather it is one mode of engaging with it.

Emphasizing Children When Considering Children and Technology

I remember taking a small group of preschool age children to visit Logan Airport in Boston. The most memorable and profound part of that adventure became the children’s response to the enormous open space in the airline terminal buildings. As if activated by embedded sensors, the children’s movement through the terminals accelerated as they swarmed the expansive area in their own uncanny terrestrial flight. Their response was kinesthetic, whole body enthusiasm. In this instance, the architecture seemed to amplify the acuity of each child’s accumulated knowledge of the relationship of her/his body to its movement in space. I do not recall what my scenario for the children’s field trip was before we arrived, but my memory of what happened has not dimmed over time.

Although this observation may seem far afield from the focus of an essay about young children, families, and technology in museum exhibitions, it is for me a compass of sorts. It is a visceral reminder that young children experience the world in ways that are distinct

from those of most adults. It highlights the power of the immediate and the compelling. It reveals the vitality of whole-hearted engagement.

Exhibitions and World Making Mediated by Technology

I think of a museum exhibition as a kind of world making, unique among publicly accessible spaces, which can be intentionally designed for young children and their families. Mutable in focus, form, scale and theme, an exhibition inhabits space as a temporary, rotating or permanent environment of experience for museum visitors. Each of these worlds embodies the perspectives, values, intentions and assumptions of the exhibition developers and designers. Whatever the expectations may be, young children engage in these worlds through sensory exploration, direct experience and relational interactions. Their involvement is not mediated by text.

I often refer to the airport visit when I am involved in the process of developing exhibitions designed to elicit particular modes of participation from people visiting a museum. As much as our attention may be directed by specific exhibition content or cultural expectations about public space, we are, to varying degrees, directly affected by the physical environments that we enter.

I began my work in museums with a deep interest and background in early childhood learning. Reflecting on my work with exhibitions and program projects in general, the modes of interaction, participation, and engagement that I explored through these forms were sparked in part by the interests and inclinations of young children and their

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families. My focus was and continues to be on the unique context for experience that an exhibition or installation environment can introduce.

I can trace my relationship to technology through specific childhood memories, my experience as an artist, and through my work as an exhibition and program developer at the Boston Children's Museum from the late 1970s into the late 1990s. Over the years, I worked on concept and prototype development and generated single exhibits and comprehensive exhibitions. The range of content, context, and collaborators, and the eclectic set of materials and technologies that I learned about in the process continue to inform my thinking today.

The exhibitions that I developed included ones within and beyond the walls of the museum. **Arts Afloat**, the floating sculpture exhibitions, were sited adjacent to the Children's Museum in Boston Harbor's tidal inlet, Fort Point Channel as well as the Charles River during the annual Dragon Boat Festival activities. **The Interactive Check Up** exhibitions were developed for families who spent time in the pediatric waiting rooms of community health centers. Some of my work focused on the ecology of Boston Harbor and its resident life forms, experiments in re-configurable green architecture, installation art explorations with sun and wind, as well as time-lapsed and interactive video works of the remarkable waterfront site that was the front yard of the museum.

Exploring Technologies, Ancient and Emerging

A precursor to these projects was my introduction to the museum exhibition development process through early projects

in the 1970s with science educator and museum exhibition developer Bernie Zubrowski. His projects acquainted me with ancient technologies. Inspired by his work, my brother and I made a woodcarving, treadle lathe powered by the springy energy of a bending branch. The lathe became part of Bernie's DIY (Do It Yourself) style ancient technology exhibit. I continued working with Bernie for several years to prototype activities that later evolved into exhibition elements, from Bubbles to Raceways. In the process I honed my understanding of interactivity and participation and clarified the aesthetics of my personal approach.

Concurrent with my graduate studies in art and technology at the Massachusetts Institute of Technology's Center for Advanced Visual Studies in the early nineties, I worked on a museum expansion project at the Boston Children's Museum that emphasized the use of a range of technologies to enhance the experience of "being here now." Conceptually, the intention of this exhibition was to bring visitors into a floating exhibition center. The idea was not to enter an alternative world but to re-engage with the dynamic waterfront site that was home to the Museum. During this research and development phase I began to explore digital technologies that extended the scale and reach of our senses while also developing exhibition concepts that prioritized direct bodily knowledge.

At the dawn of the new millennium, when I made a transition from my work at the Boston Children's Museum to an appointment as artist in residence at the MIT Media Lab, I was using interactive multimedia that processed video and sound files, sensed the presence of



Luminous You is a reconfigurable, child-size body puzzle containing pieces made with MRI and X-ray images. Courtesy of Diane Willow.

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visitors and extended their senses in the process. Simultaneously, I was involved in collaboratively developing afterschool activity kits with community educators. We used accessible technologies such as mirrors, lights, and laser pointers as well as transdisciplinary themes such as Rainbows, to introduce creative explorations that connected Culture, Art, Technology and Science (C.A.T.S.).

In my experience, it is not uncommon to hear people talk about technology as “other,”

something generated outside of the sphere of human experience. Yet the tools, the technologies that we use are human inventions and creations. Preschoolers may best exemplify the impulse that we associate with technology, the desire “to build and make and do” (Jones-Rizzi, 2002) that is closely related to the tools and craft, the “techne” that our species uses in dynamic relationship to our environment.

A 15-year Cycle of Participatory Environments and Interactive Exhibitions

Young children are active learners. They learn while doing and they play while learning. Experiential exhibition environments can become catalysts and supports for this mode of engagement. By highlighting several exhibitions I will share some observations of young children and families relating to technologies in general and digital technologies in particular.

Under the Dock

Under the Dock brought the tidal marine environment in front of the Boston Children’s Museum inside. In this *Alice in Wonderland-*

like exhibition space, barnacles, mussels, sea squirts, and anemones were presented as toddler-sized objects attached to piling structures that rose to the wood planked ceiling in this theatrical setting. The attributes of the physical environment, combined with an ambient soundscape that included overhead footsteps and the lapping of incoming waves, convincingly conveyed the feeling of being under the dock.

Children could embody the life forms so unlike themselves by donning the backpack costume of a rock crab or the at-the-surface hat of a floating sea jelly. *Under the Dock* also contained small aquaria with the living counterparts of these organisms. As usual, they provided the natural magnetism unique to living things within the cultivated context of museums. Children extended their vision with video viewers, offering close up observations of these subtle life forms, including barnacles combing the water for food and mussels navigating the rocky bottom with their single foot. This framing of the slow-paced action in the aquaria was transmitted to a remote video screen that was embedded in a faux concrete block, sunken urban debris. This interplay between interactive sightings of the living organism, their re-scaled theatrical representations and the opportunity to “be” the creature provided a meaningful context for introducing children and their families to life “under the dock”.

Days in the Life of Fort Point Channel

Days in the Life of Fort Point Channel represents another exploration in using technology to expand the senses. It featured over four years of time-lapsed video recorded from a window overlooking the Museum’s site. Edited and compressed into visual narratives that

used accelerated time and slow motion to reveal everyday phenomena, a linear and an interactive video version were included in the *Boats Afloat* exhibition. Using a set of categories depicted with legible icons, including the sun for day, moon for night, boats, birds, etc., children could select clips to replay a video recorded from the same point of view seen through the adjacent window. These visual vignettes drew the viewers into this same site in the thick of a blizzard, the saffron dawn of a summer's day, the bustle of the Dragon Boat races in June, and the peek-a-boo appearance and disappearance of tethered boats along the boardwalk, rising and falling with the tides. Speed, the pace of time, could reveal or conceal. Slow motion views of the sky were lovely, but once the pace was increased times ten, the prevailing wind was a pervasive force that could not be missed. Conversely, the circling of a tugboat breaking a path in the winter sea ice disappeared from view if the video speed was increased. When seen at a slow pace, the boat moved as if choreographed by a ballet dancer.

Interactive Checkup

Outside of the museum, in the pediatric waiting rooms of neighborhood health centers, the Howard Hughes Medical Institute funded the *Interactive Checkup*. The exhibit *Looking Large* introduced a video magnifying glass with physical "discs" of anatomically themed objects: skins and scales, fur and feathers, teeth and claws. The inherent beauty of the underlying structures of these magnified forms provided an open and accessible context for children and their grandparents, aunts, cousins and parents to talk about the body and ideas related to form and function. *Luminous You* extended this anatomy theme with the

introduction of a life-sized puzzle and an expanded set of puzzle pieces. Constructed with direct digital MRI images of organs and x-ray images of bones, embedded in transparent acrylic, children and their families could select pieces of the puzzle to construct layered views of the insides of a child's body. With more than one option providing the fit for each of the puzzle areas, a child's composed view of the body might include the veins of a hand, the bones of the rib cage, or the brain within the skull area. A completed puzzle of the body, framed within the silhouette of a child-sized light box, might juxtapose composite views of body systems and layered perspectives, each a unique snapshot of these relationships. There was not one right way to compose a view of this body. Metaphorically, *Luminous You*, revealed what your eyes might see if your vision could extend beneath the surface of your skin to any depth in any area.

Public Installation: Wave Garden

Concurrent to the development of these exhibitions, I was making interactive art installations and experimenting with large, interactive, sculptural objects with the capacity to create environments of experience. Installations like the *Wave Garden* were designed to be socially engaged public spaces for contemplation. Contrary to common expectations, preschool and early elementary aged children engaged in the same relaxing behavior as the adults, reclining on the floor of this fourteen foot high, cylindrical, cotton mesh space, while gently moving the custom designed Wave Ring sound makers according to their chosen rhythm. Expanding waves of light and shadow activated the vertical surface of this netted cylindrical structure. Each succeeding wave revealed concentric shadows

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that expanded and contracted upon the surface of this space. Each echoed the interplay of the overhead light passing through a tray of water periodically activated by water drops falling onto its surface.

Public Installation: *Eyes of the Wind*

In contrast to the calming space of the *Wave Garden*, *Eyes of the Wind* was a dynamic sculpture with a diaphanous membrane-like structure. From a distance it looked like the film of a soap bubble stretched across a series of nine-foot high hoops. This plastic film-covered structure formed a series of passageways on either side of a series of transparent film enclosed “envelopes.” The passageways invited children to play. Reminiscent of the traditional children’s game, “In and Out the Window,” the children moved in and out of these passageways. Upon their approach they activated a series of blowers that in turn activated leaves that swirled in a benevolent maelstrom within the enveloped areas between the passageways.

Each one an invitation for whole body sensory engagement in a dynamic social context, these public installations used technology to heighten people’s awareness of natural phenomena such as wind and waves. These were the readily accessible phenomena of urban life, commonly encountered as wind in the trees, ripples on the surface of a puddle; yet in these interactive environments, the technologies magnified young children’s experience of attributes commonly associated with unmediated encounters with nature.

The PIE (Playful Invention and Exploration) Network

In many of the exhibitions described previously the technologies were integral to the work, but not necessarily reconfigurable by visitors. Over the course of a three-year, collaborative project as part of the Playful Invention and Exploration (P.I.E.) Network (www.pienetwork.org) at the MIT Media Lab, I experimented with a series of social sculptures that involved young children and their families directly in the process of constructing their own interactive experiences (Resnik et al, 2001). In partnership with an extraordinary group of museum collaborators, we developed and facilitated large-scale family events (MindFests) that explored a variety of interactive and emerging technologies. They were inspired by the original 2-day MindFest at the MIT Media Lab in the fall of 1999. The PIE MindFests became experimental forms as the PIE Network collaborators activated areas within existing exhibitions while also introducing new temporary exhibit elements.

The Sound Tree is an example of an ephemeral sculptural object that was installed and transformed during a MindFest public



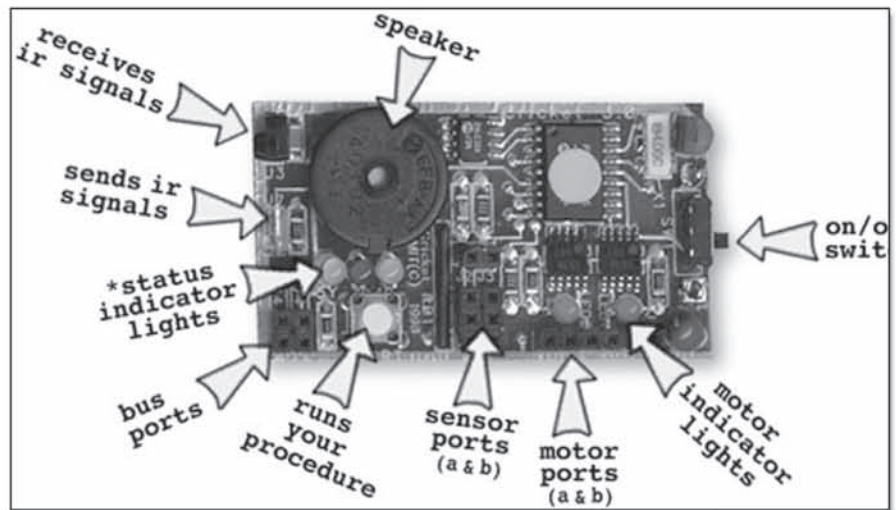
The Eyes of the Wind installation invites children to run in and out of the passages created by transparent envelopes containing dried leaves, activating blowers that make the leaves swirl. Courtesy of Diane Willow.

programming event at the MIT Museum. A whimsical, branching, conical tree was made from poles of bamboo and rings of black tubing. This wire-frame inspired structure became a substrate for the attachment of playful, sound making inventions. Children were invited to design and make their own soundmakers. The varied and appealing characteristics of a dazzling palette of materials and the movements of an array of pre-assembled, Lego constructed, mechanical motion-making components provided inspiration. Sparked by the kinetic motions and the materials, children, families and clusters of playful people created sound elements of their own design. Each incorporated a sensor that sensed light, distance, or touch; motors and motion modules that activated the sound makers; and a small computer, the “cricket,” that processed the interactions. Over time, as each sound maker was added to the sculpture, it became animated with the movement and sounds of a lively chorus of interactive sound sculptures activated by people visiting the Sound Tree.

Invention at Play

Our experience with the MindFest programs informed some of the approaches explored in the development of the **Invention at Play** (www.inventionatplay.org) exhibition, project of the Lemelson Center for the Study of Invention and Innovation at the National Museum of American History in collaboration with the Science Museum of Minnesota (Lemelson Center, 2002). I worked as a consultant to the Science Museum of Minnesota to develop an area of the exhibition called the Invention Playhouse. I also worked with the MIT Media Lab as a co-author of the PIE Network project and a project collaborator on other aspects of

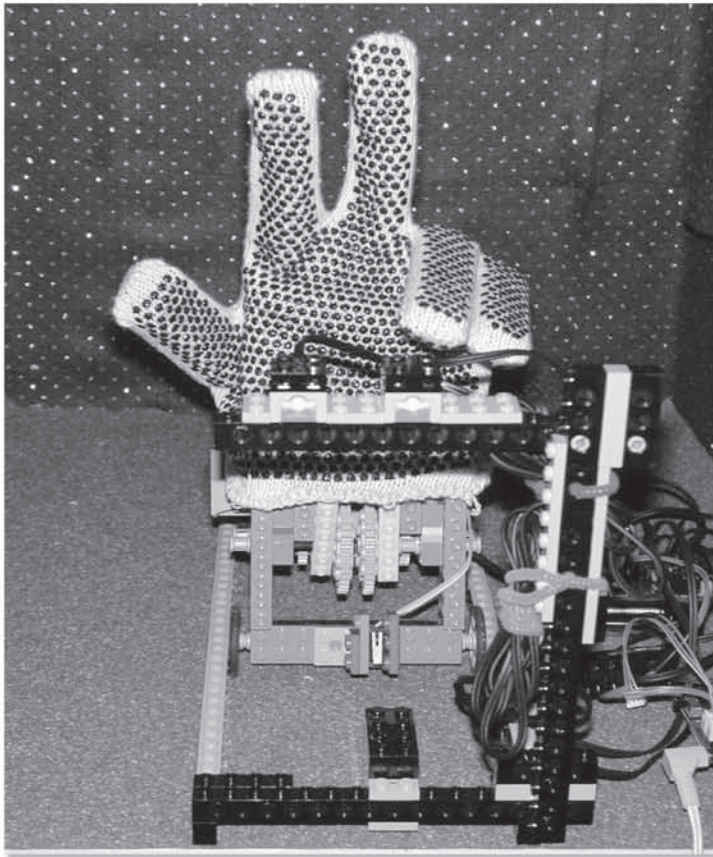
the exhibition: the Future of Play area and the Playful Invention and Exploration (PIE) Activity Cart.



The MIT cricket, slightly larger than the 9 volt battery that powers it, is a small computer that can be programmed to sense the world and display sound, light and movement in response. Courtesy of the MIT Media Lab.

Overall the exhibition was designed to “bring a fresh perspective to the topic of invention, exploring the marked similarities between the ways children play and the creative processes used by innovators in science and technology”(Jennings, 2007).The Invention Playhouse offered children, their families and caregivers a place to explore some of the habits of mind associated with the process of invention and to experience their creativity as they participated in exhibits designed to make playing together fun.

Digital technology is often portrayed as a world that is accessible to the young and impenetrable to the old. To connect all visitors with notions of the future we explored the feasibility of including programmable technologies with



This is an inside view of Musical Digits before it was enclosed in the interactive diorama or PIE box. These fingers mirror the movements of visitors as they press buttons to play with the movement of the digital hand and the accompanying musical sounds. Courtesy of Diane Willow.

the inviting, open-ended quality apparent in the material-based technologies described previously. The MIT Media Lab was a natural partner in this endeavor since the collaborative Playful Invention and Exploration (P.I.E.) Network project, was in its research and development phase at the same time. The diminutive “cricket” readily shifted the typical concept of a computer from one that is the size of a desktop computer to one that takes form as an exoskeleton, a carapace for a 9-volt battery. Its intimate scale; its endearing sonic chirp when switched on; and its handheld, portable nature were appealing. Equally compelling was the creative community of museum educators involved in developing engaging activities with the cricket. Without this effort our attempts to stretch the boundaries of the exhibition would not have been possible.

This goal of making the manipulability of digital technology accessible, so that it is on par with that of an infinitely responsive

material like clay, emerged as an ongoing goal rather than an accomplished milestone. It is a vision that is still in process and one that elicited much discussion. In the end we included the “cricket’s” programmable technology within the mediated context of the PIE Activity Cart and a series of performing dioramas, the PIE Boxes.

From my perspective, one of the strengths of this exhibition was the spectrum of technologies that it incorporated. The Playhouse contained commonplace manipulatives featuring kitchen utensils that could be reconfigured, colorful plastic shapes for pattern making, foam pieces for shaping whirligig wind catchers, and wooden building blocks for balancing constructions.

Recognizing that experiences relating the unfamiliar to the familiar help museum visitors to engage with new ideas, I developed Rocky Blocks for the Playhouse. It combines building with blocks, a quintessential early childhood activity, with a precarious and hilarious tabletop that is mounted upon a wobbly hemisphere. The unlikely presence of this hemisphere with its unstable surface invites “surround play” that easily involves people with varying levels of experience. This is an example of a technology that shifts the conventions of our expectations. The block-building surface is no longer fixed. The familiarity of the core activity makes this approachable to young children and adults alike. The slightly skewed element of the inherently risky surface invites experimentation with less of the conventional fears of failure attached.

Whenever a facilitator brought the PIE Activity Cart into the exhibition space, children and their families would eagerly

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engage with some of the manipulable aspects of digital technologies. The cart activities offered the active engagement characteristic of the Playhouse activities like Rocky Bocks combined with the unique affordances of new digital technologies. At the cart, visitors could see how the "cricket's" interactive digital technology could activate ordinary materials like water, ice, crayons, or playdoh. This kind of activity begins to introduce a wider space of open exploration for young children while developing new ways of knowing about their world through direct engagement.

The power of the ideas inherent in programmable technologies was not directly accessible to visitors in this scenario: after much deliberation it was determined that it was not practical nor possible to provide children or adults the staff support needed to program the cart activities themselves in the context of the exhibition. The activities were programmed by staff and led by a facilitator who had participated in an onsite PIE activities workshop. As the *Invention at Play* exhibition toured the country, we found that these digital components were enormously engaging to visitors of all ages. However, the new and exploratory state of the "cricket" technology required frequent maintenance and called for mostly facilitated experiences as well as special learning experiences designed for interpretive staff. As a result, these experimental features are no longer part of the exhibition; but for several years *Invention at Play* provided a traveling laboratory for the possibilities (and challenges) of including emerging technologies for children and families in an exhibition format.

Two Paths Less Traveled

Reflecting on this broad-brushed and

admittedly biased portrayal of some of the ways that young children and their families have engaged with technologies in exhibitions, it is clear to me that there is so much more to explore. Two modes seem particularly promising to me.



The Rocky Blocks' unstable surface brings a new challenge to building with blocks. Courtesy of the Smithsonian Institution, National Museum of American History.

The first is an advocacy for more experimental exhibition spaces that support ephemeral, short duration, installation art environments for young children. These may be highly kinesthetic, involving children in call and response modes of interaction with digital technologies that explore single concept themes such as Big, Blue, Under, or Soft. Somewhat performative in nature and theatrical in design, these themes may use projections, sensors, tangible media and sensual materials. The priority would be aesthetic, with the varied media encouraging young children to explore related concepts in spaces and with objects that give immediate and compelling

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sensory feedback.

The second focuses on direct experiences with programmable technologies that reveal the process of designing behavior. Children are accustomed to doors that open for them, appliances that are controlled remotely, lights that detect motion, and toys that speak to them. Hybrid exhibition/studio spaces have the potential to involve children and their families in the process of making their own responsive objects or adding their sensibility to existing objects by re-programming them and imbuing them with new characteristics. The presence of this kind of active, in process exhibition offers children and their families the opportunity to “build and make and do.” It invites them to

be active participants in their learning process and to do so in the socially engaged and creative context of a museum environment. The burgeoning DIY culture creates an extended context for this approach.

Existing technologies, exhibition strategies, pedagogical approaches and the presence of talented educators, exhibition developers, artists and designers make these two modalities realizable. It seems that the allure of emerging technologies continues and the appeal of the sensory, material world persists. The hybrid zone that they create is a dynamic one that invites us to take some risks with the forms, content and contexts that we design for young children. ✨