
II. INTRODUCTION

A. Forum Introduction & Goals

Rob Semper, Executive Associate Director, Exploratorium

I am the Executive Associate Director of the Exploratorium and am also the head of the Center for Media and Communication, which houses the Electronic Guidebook Project, the program sponsoring this workshop. My role is to push and prod the discussion along with assistance from other staff members and I am hoping that we will have an excellent two days of discussion. I would like to begin by thanking you all for coming.

Background

I want to talk a bit about the project that got this started, why this meeting is happening, and our excitement about planning this session. In 1999 the Exploratorium submitted a proposal to the National Science Foundation for an "Electronic Guidebook" research project. The NSF division funding this project, Informal Science Education, doesn't normally fund research. They provide money for things like exhibits, NOVA, and IMAX, and this is one of the first research projects they have funded. We didn't promise implementation as part of this project. We said it would be a research testbed to investigate the use of handheld computers and wireless networks to enhance the learning experience in a science museum setting.

The project involves technology testing, usability testing, and interface testing, and is being conducted with the help of two partners. The Concord Consortium helped to develop the initial research prototypes and approach and to explore the particular issue of real-time data collection. Subsequently we established a relationship with Hewlett-Packard Research Labs to develop the current testbed infrastructure and to push forward on technology testing, usability testing, and interface testing.

In the midst of the testing and development we have seen two generations of Windows CE and development of 802.11 wireless network from the lab to something you can buy at Costco. We continue to engage in experimentation and research.

Networking and Documentation

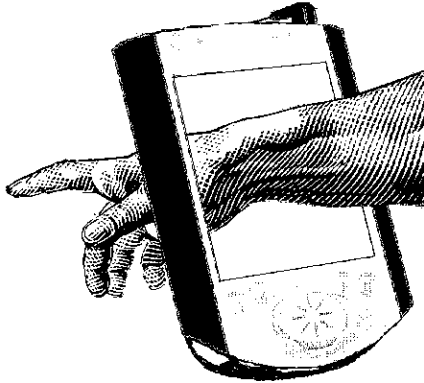
An important part of this project is dissemination. We are not only a testbed, we want to engage other museums in the question of how these tools can be used in these complex, messy settings. We had the idea of holding an invited conference for participants from all walks of life: museums who are already doing projects of this type as well as those who are just starting to think about it; academic researchers; and industry representatives, to address issues of how this can be used in the real world. We wanted to bring these different groups together to talk about where we are globally in thinking about the issues with which our project is involved.

We decided to create a significant documentation of the conference for those in the museum field, in industry, and in academic research interested in the use of

Thanks to Forum Organizers

I would also like to thank Natalie Rusk, Mirjana Spasojevic and her Hewlett-Packard team, Doug Conaway, Jessie Gauld, and the other Exploratorium staff members who helped to organize this forum.





computers in a more fluid, ubiquitous way. By involving a mixture of exhibit developers, educational technology researchers, and commercial developers in focused discussions we hope to explore questions of electronically networked augmented space in a way that stimulates future research and implementation.

We want to take various strands – what is working now, what questions do we have, what have we learned, what are promising directions, what are not so promising – and through documentation, help others move on whether they are implementation projects or research projects.

Forum Goals and Process

So this is a conference to stimulate discussion, to help develop a road map of what the future direction could be. We don't expect to emerge with the road map itself. We do expect disagreement, but we hope to at least establish pointers.

For those of you at this session engaged in your own endeavors, these discussions may help you in your own projects, so it is appropriate to be selfish. The hope is that your selfishness stems from a strong connection to the work being done which in turn will contribute to the depth of these discussions.

This forum is not like a museum conference, it is not exactly an academic research conference, it's not companies getting together to work on industrial strategies, but nor is it blue sky. We have invited representatives from museums, universities, and industry, to create an eclectic gathering and we would like you to take advantage of that mix. Don't sit with your colleagues, sit with someone new. We hope the dialogue between these different groups will improve the overall discussion at large.

We will begin with individual introductions that relate your personal interests in this field. Then to seed the ground we will hear presentations from six projects that have actual, physical experience in different museums and locations. Afterwards we will have a chance to play with the devices being used in these various settings.

Then we spend time on some key questions, discussing what is working, what is not, and what we would like to know more about, and see if we can collect or organize these ideas into six categories. The idea is to focus the discussion into domains. On day two we will continue discussion, and break into smaller work groups to explore some of these issues in depth.

The tone of the meeting is meant to be informal. Feel free to talk, argue, question, support each other. We are not too concerned with protocol. My role, and that of other staff members, will be to try to guide the discussion, ask probing questions, and keep the focus, but not steer the discussions in any particular direction. The point is to get out on the table issues we need to address as a group and I would like you to think of this as one giant collegial group.

3 Key Questions

- Which aspects of using handheld computers in museums do you find most promising?
- Which aspects concern you the most?
- What unanswered questions do you have about using technology in museums?

6 Organizing Categories

- Audience and goals
- Technology infrastructure
- User interface
- Content Development
- Staffing and operational issues
- Research and evaluation (visitors studies)

B. Individual Introductions/Interests

Mirjana Spasojevic, Project Manager, CoolTown Program, Hewlett-Packard Research Laboratories

As a conspirator on the project I would also like to welcome you all here. I am from Hewlett-Packard Labs, a central research organization for Hewlett-Packard. We are not part of marketing or divisions, we get to do the fun part _ looking at technology, making prototypes, studying various scenarios, which we then eventually transfer to product divisions.

This project, the Electronic Guidebook, is pushing the typical behavior at Hewlett-Packard Labs which is a set of demonstrations in a room. This time we thought : What if we go out and try it out on a lot of people? This collaboration has presented a unique opportunity to work with people who are not like ourselves, and to interact with real museum visitors.

Andrea Bandelli, Museum Consultant

I am from the Netherlands and am an independent consultant. Recently I have been working on a digital program on Life Science that involves eight major science museums in Europe, and I have been assisting a new science center in Torino, Italy forge stronger links with industry and research labs.

I'm here because I'm interested in new technology and because I work with so many individuals and museums in Europe that it is easy to create new programs. So I'm serving as a sort of ambassador. Previously I worked on an Amsterdam science center project to inform staff about what is happening on the floor. The attempt was to get as much information as possible from visitors.

One form of technology with high potential is cell phones. In Europe they are crazy about cell phones. Sixty to seventy percent of people in Europe have cellular phones. It's an easy way to exchange information and it's a technology people are confident with. Young people already exchange more text messages than audio messages. So I'm interested in the role of mobile devices as part of a project that is working on the role of visitors as curators at a museum in Frankfurt.

Tom Steller, Chief Curator, Natural Sciences, Oakland Museum

I head up the science department at the Oakland Museum. The museum has been looking at reinstallation of all three major galleries. In the science gallery we have a traditional presentation in a number of ways. We are looking at ways to change the visitor experience so that they have interaction with the content there, content that is now not accessible. We are looking at handheld devices and other assists as a component of this so it is timely to explore what is out there.

Rakhi Rajani, Researcher, Hewlett-Packard Research Laboratories

I am from the United Kingdom and am currently an intern at Hewlett-Packard Labs, looking at the usability issues of handheld devices.

Introduction Guidelines

The idea is to have everyone introduce themselves and as part of that introduction briefly describe their interest in the topic, whether that involves a project you are doing, one you are thinking about doing, or whatever your interest might be. • Rob Semper, Executive Associate Director, Exploratorium

Melissa Alexander, Project Director, Origins, Exploratorium

At the Exploratorium I'm involved in an effort to bring people behind the scenes to observatories and laboratories around the world to look over the shoulders of scientists. My interest in technology is the opportunity to give visitors greater depth and to alter information and experience for themselves. I see it as a tool to move beyond the museum out to the world.

Michael Petrich, Co-Project Director, Playful Invention and Exploration Network, Exploratorium

I have spent the last couple of months working on the content of the Electronic Guidebook project.

Kathleen McLean, Director, Center for Public Exhibition, Exploratorium

I'm Rob Semper's colleague and am very interested in appropriate use of this technology. I have been working with Tom Steller of the Oakland Museum, and have been urging them to go forward on handheld devices. I'm interested in the usefulness of these devices and my guess is that they present a wonderful new opportunity which has less to do with access than it does with contemplative and observational experiences. I wonder about highly interactive experiences and how these compete.

Doug Conaway, Resource Development Director, Center for Media Communication, Exploratorium

I'm involved in fund raising, strategic thinking, and development, and want to glean ideas for future research and programs. I also work on external relations with various entities so I'm pleased that this forum involves entities from outside the museum world. I'm interested in exploring how the museum can play a broader role.

John Turner, Learning Studio Facilities Coordinator, Exploratorium

I'm new to the Exploratorium but not to experiments in technology. This is the first job where people are researching how handheld devices can be used.

Keith Braafladt, Director of Learning Technologies, Science Museum of Minnesota

I work with kids and adults and technology. I have been interested in how handheld computers are like Legos – you can create inventions. I'm more interested now in adult devices, but I am really skeptical. My background is in art. I'm not sure these can be put to good use in an art museum.

Margaret Pezalla-Granlund, Museum Consultant

I am a consultant and also work as a museum educator at the Los Angeles County Museum of Art. My background is in art, but I work as much in science museums. I'm interested in the use of handhelds in messy environments like the Exploratorium, but also in art museums.

Kristina Hooper Woolsey, Consultant

Rob Semper and I have been talking about connections between real space and virtual space for the past twenty years and I am interested how handhelds can enhance that. I have been with Apple for fifteen years, working with multimedia and human interface. Now I'm on the other side, working as a consultant for the Irvine Foundation on an initiative involving communities organizing resources to enhance learning for underserved youth. It is a collaboration involving a range of cities, exploring how to provide for kids learning through educational opportunities in the community, outside of traditional schools. I suspect with handheld devices and other opportunities (I'm interested in acoustical signals) it is possible to design something completely new.

Susie Wise, Senior Producer Interactive Educational Technologies, San Francisco Museum of Modern Art

We will be presenting information later today about the Points of Departure exhibit at the San Francisco Museum of Modern Art. We are in the process of evaluating how that works. I'm looking forward to hearing about other future museum and Web projects and other I'm looking forward to future SF MOMA work in that area. On the logistics side what is exciting about this for us is getting movies into galleries –not just off to the side, which is the typical model, but right there with the art.

Genevieve Biggs, Public Information Officer, Moore Foundation

I'm here as an observer for the Moore Foundation. Gordon Moore, the founder of Intel, is a fan of the Exploratorium. My role involves external and internal communication for the foundation, and I'll be reporting back on this forum to the foundation. I'm excited to hear what you are all doing.

Daniel Molitor, Consultant

I am an independent consultant and was one of the original team from Walt Disney Imagineering working on designing exhibits for Port Discovery children's museum. I also work on the Kid Club at Port Discovery and will be talking more about that later, and addressing issues of how handheld devices can be used to encourage physical interaction with exhibits.

**Jenna Burrell, Application Concept Developer,
Intel Architecture Laboratories**

I'm here as a stand-in for Richard Beckwith, and I've been with Intel for four months. Before that I was at Cornell working on context aware computing which has obvious implications for a museum environment. I'm now with a group doing ethnographic research on museums and people.

Rachel Hellenga, Director of Exhibits, The Tech Museum of Innovation

We are launching a couple of different projects. One, dealing with the issue of sustainability, is the smart museum initiative. As things in science and technology are changing fast we want more updatibility of components. I'm involved in developing something called smart museum bracelets. My colleagues call it the "magic bracelet." Why a bracelet? We wanted disposability and cheapness but at the same time we wanted something highly interactive that wouldn't occupy the hands.

Michael Drennan, Technology Developer, The Tech Museum of Innovation

I'm involved in hardware and software design and am interested in new technology and ideas we might use in the smart museum realm – specifically, wireless technology and what visitor experiences with that technology would warrant our time in developing it and their time in using it.

**Craig Rosa, Director of Information Technology,
The Tech Museum of Innovation**

Part of my role is overseeing the Web site and I continue to be interested in development in that area. Today my interest is in handheld devices and wireless technology and the Web site – and how those three can be developing in parallel in a way that really makes them work. Regarding my feelings for wireless technology, someone earlier expressed valid skepticism. I'm at the other end of the spectrum. I'm interested in content and how to make it work. I'm interested in where wireless fits in the spectrum of the learning continuum, in the effort to develop and provide good content, in the holy grail of establishing a relationship with visitors.

**Judith Kirk, Assistant Director, Mathers Museum of World Cultures,
Indiana University**

We are a museum of anthropology and we are a small size museum. We have been involved in a project called MUSEpad, which I will be talking about later, involving mobile computing for people with disabilities. I've always been interested in reaching different audiences and in human-computer interface, and have entered graduate school for further study in administration of assistance technology. During the MUSEpad presentation I will also be talking about how we collaborated with an information development company.

Stephen Bannasch, Director of Technology, Concord Consortium

I will be presenting later today and have brought a lot of toys for exploring the world through probes and sensors. We have been working since 1995 with handheld devices through the SLiC, Science Learning in Context project. My

**Larry Shaw, Senior Media
Specialist, Exploratorium**

I'm with the Center for Media Communications which offers support for communication projects including this handheld project. I'd like to kibitz, to use the consciousness here to talk about engaging people in an ongoing way in a broader sense.

**Katherina Audley, Content
Developer, Electronic
Guidebook Project,
Exploratorium**

I've been developing content, videos, JPEGs, and so forth for the Electronic Guidebook project and throwing them into the device. Now we're looking at what is working and what isn't. I'm curious about what others are doing before dumping a tremendous load into their own gadgets. I also do visitor research and evaluation, watching visitors interact with exhibits, and I also work on Webcasting, so I'm in a lot of different places in the museum.

Natalie Rusk, Project Director, Electronic Guidebook Project, Exploratorium

I'm working on the Electronic Guidebook Project. When I came to the project I hadn't paid much attention to handheld computing though I had worked with computers. I heard a term that I think is useful in describing my relationship to this: "skeptical friend." Part of why I became involved in this project is because I heard that it involved a group of people from a variety of museums coming together for this discussion.

Susan Schwartzberg, Senior Artist, Exploratorium

I have a different involvement with technology. I'm interested in the expressive potential, whether getting information or creating information.

When the World Trade Center happened, there was the role that all those phones and pagers played during the event. I think it is something profound that happened but it's not talked about.

I'm also working on a project, The Mind & Learning grant, about consciousness and the mind and how we think. I'm hoping these devices can help us collect those thoughts and serve as "epiphany gatherers."

interest is in looking at the world and how that can be represented on a computer and the interaction involved. Handheld devices are of interest to us at the Concord Consortium because they allow portability – you don't want to constrain kids to a lab table. They also allow representation of data you have collected.

Since 1995 we have been a member of CILT, the Center for Innovative Learning Technologies, and we are responsible for the Ubiquitous Computing theme in CILT. We have several projects now that involve using handheld devices including: the Exploratorium Electronic Guidebook project; Probeserver and the Data and Models thermal conductivity system; TEEMSS and CC Probeware; and Modeling Across the Curriculum.

Jim Thornton, Member of Research Staff, Xerox PARC

My background is in systems software, working behind the scenes, so this is new to me. I'm interested in the issues concerning what goes in – content development.

Allison Woodruff, Member of Research Staff, Xerox PARC

I'm also from Xerox PARC, an industrial research lab in the South Bay. I've been thinking lately about electronic guidebooks as they relate to historic houses and visitors studies. For example, does a shiny object in your hand distract you?

Paul Aoki, Member of Research Staff, Xerox PARC

I have a background in systems software which, as Jim says, is behind the scenes. Xerox PARC has a long history in the area of ubiquitous computing and human-computer interaction. For me, studying the use of technology in a historic house is an opportunity to learn about these methods. Museums and historic houses are interesting settings because we want the technology to disappear – not physically, but in terms of people's attention.

Tim Kindberg, Scientist/Engineer, Hewlett-Packard Research Laboratories

I am a systems software person. There's a fascinating side to ubiquitous pervasive computing. We have lots of devices on us, and the world has lots of devices in it. I work on what bits of software go onto this or that. I'm also interested in evaluation, and was involved in an ethnographic study on caring for diabetic patients. I am also a sceptic and what counts as evidence as criteria of effectiveness. What is going to count?

Eamonn O'Brien Strain, Research Scientist, Hewlett-Packard Research Laboratories

I also have a technology infrastructure background, in particular working on the infrastructure to support social communication and streaming media. I'm impressed by the power of today's PDA's. They can fit on your watch, they're always on, twenty-four hours a day. What are the implications of that? What technology makes sense?

Michael Schiess, Project Manager, Physical Science Interpretation, Museum of Science, Boston

I'm intrigued by the quality. You have a cyber animal tracker built for Kalahari bushmen and now kids in a museum use handheld devices. We have a large scale activity center at our museum. I'm fascinated in how kids learn about models, create models, and use models. I'm interested in what the Concord Consortium is doing. We're in the initial phases, looking at what probeware might look like.

Margaret Fleck, Senior Researcher, Hewlett-Packard Research Laboratories

In the misty past I was involved in social sciences and did actually work in a museum. My present interest lies in how to use handheld devices in a variety of situations. For example, the home environment: what could they do for you in our home without being irritating. I also work on interfaces that might involve speech.

Scott Beveridge, Internet and Multimedia Exhibit Manager, Museum of Science and Industry, Chicago

I'm here just to put a toe in the water. My task is to get the lay of the land and learn about different options and what is of value for different activities. So for me this is an embarrassment of riches. I'm listening from the operations side, the visitor side, and the financial side, to learn about opportunities for museums.

Marcos Frid, Research Engineer, Hewlett-Packard Research Laboratories

I've been working on a lot of the technology that you'll see used in the Electronic Guidebook Project. I joined Hewlett-Packard several years ago working on small embedded Web servers, which grew into more sophisticated technology. We saw the need for a level above it of services which we call CoolTown. We hung two Van Goghs on the wall so now we have a little museum.

I am mostly involved in getting things to work, and in figuring out how to tweak technology that has already been developed in the challenging environment here at the Exploratorium.

Rob Semper, Executive Associate Director, Exploratorium

I have a couple of thoughts after hearing your introductions. It's wonderful to hear about people's backgrounds, and I'm struck by how this has realized a dream of mine. It's like a dinner party to which you invite a mixed group and the whole goal for this session was to create a crossover, a mix. I think that has happened and now we can bring this to fruition in the next day and a half.

