Visitor Behavior and Experiences in the Four Permanent Galleries at The Tech Museum of Innovation

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ABSTRACT **This article presents a few salient findings from Phase I of an evaluation conducted at The Tech Museum of Innovation. Phase I focused on articulating visitors' behaviors and experiences in each of the four permanent galleries. Observations showed that visitors are spending about the same amount of time in the galleries as they spend in other museums' nondiorama exhibits, but they visit fewer components. Because some galleries performed better than others, this manuscript provides a rationale for the range of behavioral data by examining behaviors at various component types. In-depth interviews provide another perspective on the visitor experience. They showed that in some cases visitors are not grasping the individual messages of the galleries. Observation data suggest why visitors failed to obtain the galleries' big ideas. The challenge for The Tech is to consider the unique behaviors that the exhibits promote and to rework their exhibits so they more strongly reflect and convey each gallery's big idea.**

BACKGROUND INFORMATION

The Tech Museum of Innovation opened the doors to its new building in downtown San Jose, California in October 1998. Its mission is:

> To serve as an educational resource that engages people of all ages and backgrounds in exploring and experiencing technologies affecting their lives, and to inspire young people to become innovators in developing technologies of the future.

The Tech Museum of Innovation is the centerpiece of San Jose's economic redevelopment. Designed by architect Ricardo Legorreta of Mexico City, the mango and azure colored building is impressive. Within its 112,000 square feet are four permanent, thematic galleries. The lower level houses *Exploration* and *Communication*, and on the upper level are *Innovation* and *Life Tech*. Table 1 presents specific information (e.g.,

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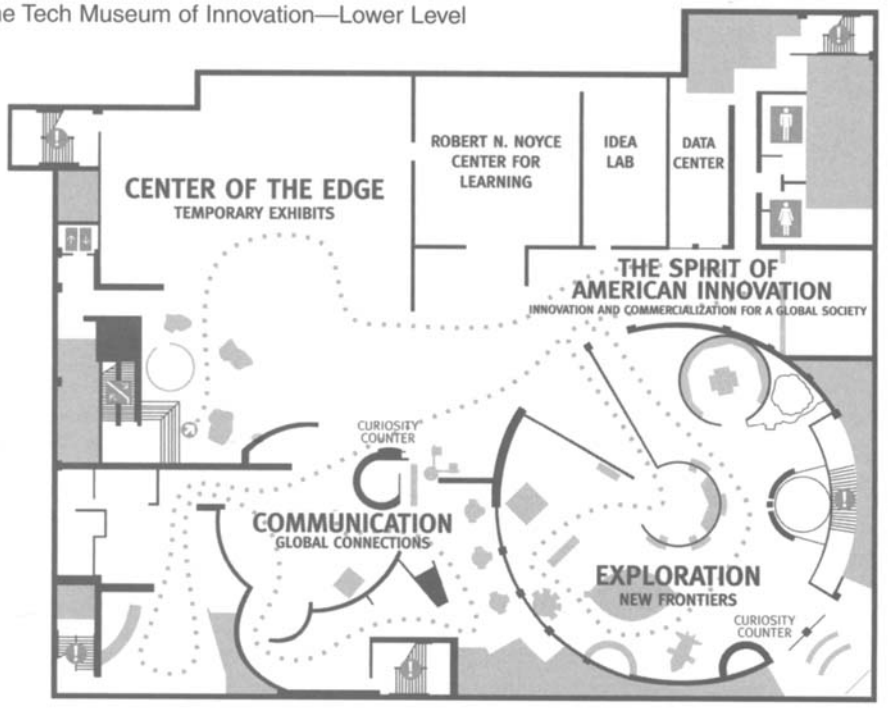
The Tech Museum of Innovation—Lower Level



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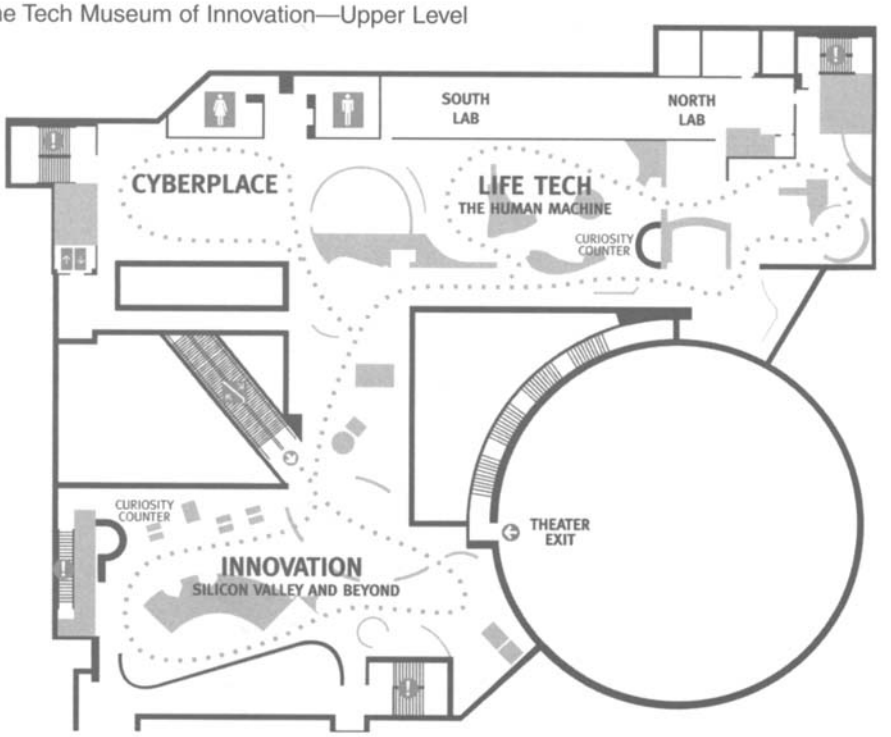

Table 1. *Gallery Information*

Gallery **Area** *(sq. feet)* **Number of Components**	**Thematic Sections**	**Gallery Objectives**
Exploration 8,306 sq. feet 75 components	1. "Perspective" (introduction) 2. "Living on a Restless Planet" (technologies used to study the movement of the Earth's crust) 3. "The Deep Frontier" (technologies used to explore the ocean) 4. "Earth Watch" (technologies used to view Earth from space) 5. "Destination Space" (technologies involved in exploring space) 6. "To Other Worlds" (technologies involved in exploring planets) 7. "Infinity and Beyond" (technologies used to study deep space)	*The Exploration Gallery* will help visitors: • Discover how advanced technologies such as those developed for sensing, sampling, and transportation support the advancement of scientific understandings; • Investigate scientific and engineering principles (e.g., the electromagnetic spectrum, physical properties of waves, Newton's laws, structural design, properties of materials) behind a variety of exploration-related technologies; • See that scientific progress involves ongoing or repeated sampling and systematic analysis of quantitative data; • Understand that computers advance science by linking scientists to live images and data, to each other, and to instruments, and by storing, organizing, and analyzing information; • Explore the technical challenges (e.g., data transmission and control systems) and scientific value of remote tools such as robotic devices, satellites, and space probes; • Apply skills in graph interpretation, map reading, and inference; • Acquire a more positive, "can do" attitude towards science and technology.

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Table 1. *Gallery Information (continued)*

Gallery **Area** *(sq. feet)* **Number of Components**	**Thematic Sections**	**Gallery Objectives**
Communication 8,113 sq. feet 42 components	1. "Perspective" (introduction) 2. "Global Networks" (telephone, satellite, cell phone, fiber-optic networks) 3. "Digital Studio" (digital media tools) 4. "Information Explosion" (information access and control) 5. "Electronic Conversations" (electronic communication tools and their virtual communities)	*The Communication Gallery* will help visitors: • Discover communication technology applications and become comfortable using them for connecting to people, finding news and information, and being creative; • Discover the power of digital media to create and manipulate media (e.g., animation, video, photos, sound); • Experience a digital media network that allows them to work on one project at multiple, linked workstations; • Discover some of the hidden aspects of communication networks, such as the satellite that links a TV truck to a TV station, the antennas that link cell phones, and the fiber-optic cable that carries messages underground; • Learn strategies and about software and hardware used to manage the impact of communication technologies on their privacy, safety, and on their children.

square footage, number of components, thematic sections, and gallery objectives) about each gallery.

Each gallery contains a range of exhibit types, including computer interactives, mechanical interactives, simulations, staffed exhibits, ethics exhibits, text panels with artifacts, and text panels without artifacts. Each gallery also includes an immersion environment (an area intended to look and feel like a real-world place).

With National Science Foundation support and funds from the museum's operating budget, an extensive summative evaluation was conducted by Randi Korn & Associates, Inc (RK&A). The evaluation was designed to examine visitors' experiences in each of the four permanent galleries and overall visitor experiences in the entire Museum. The project presented a unique opportunity for RK&A, as the chance to examine an institution in its entirety and to address the intellectual curios-

Table 1. *Gallery Information (continued)*

Gallery **Area** *(sq. feet)* **Number of Components**	**Thematic Sections**	**Gallery Objectives**
Innovation 8,252 sq. feet 50 components	1. "Greetings from Silicon Valley" (introduction) 2. "Robot Tech" (robot technology) 3. "Virtual Design" (computer-based design tools) 4. "Miniature Revolution" (history and science behind microchip function and production) 5. "Pushing the Limits" (science concepts underlying technology)	*The Innovation Gallery* will help visitors: • Discover that technology uses applied scientific, engineering, and design skills to respond to a need or solve a problem; • Learn that innovation can result in a new product or improvements, as well as in refinements to existing products or processes; • Discover how innovative technology involves the use of tools, observation, and measurement; • Comprehend simple mechanical, electrical, and electronic functions and how these are combined in complex technological devices; • See how creativity, mathematics, logic, collaboration, originality, and an understanding of science are all needed to improve technology; and • Understand that technological designs have constraints and that failures may lead to further knowledge of and improvements in technology.

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ity of museum staff desiring to understand actual visitor behavior was unprecedented.

This paper is based on the findings from the first phase of the summative evaluation that was conducted in the summer of 1999. Because of the enormous amount of data that was presented in the individual reports submitted to the Museum (collectively, more than 300 pages), this paper is intended to serve as a synopsis of noteworthy trends as well as a discussion of implications and recommendations based on the findings, RK&A's extensive experience, and general professional standards of practice.

Phase I of the summative evaluation was undertaken to document the scope of the galleries' impact and effectiveness as well as to identify elements in existing components that may need to be adjusted to improve their effectiveness. The specific objectives of the study were to determine:

Table 1. *Gallery Information (continued)*

Gallery **Area** *(sq. feet)* **Number of Components**	**Thematic Sections**	**Gallery Objectives**
Life Tech 7,870 sq. feet 65 components	1. "Perspective" (introduction) 2. "Med Tech" (medical technologies) 3. "Life's New Frontiers" (biotechnology applications and issues) 4. "Imaging" (imaging technologies) 5. "Beyond Our Limits" (performance enhancing technologies)	*The Life Tech Gallery* will help visitors: • Think about their bodies differently as they discover and try out technologies related to the human body in the areas of medicine, sports, imaging, and genetics; • Learn about technology in the personal context of their own bodies; • Discover that technology is pervasive in medicine and health care: technology has changed the way we diagnose, treat, and prevent disease or injury, extending the abilities of the health care practitioner and influencing an individual's self care options; • Discover how the investigation and medical work with genetics is accessible because of technology; • Gain new perspective on many of the ethical issues raised by technologies related to the human body.

- how much time visitors spend in each gallery
- how much time visitors spend at individual components
- the components at which visitors stop
- visitors' opinions of each gallery
- visitors' cognitive experiences in each gallery.

METHODOLOGY

Data collection took place in July and August 1999 by trained data collectors. Three data collection strategies were employed to assess visitors' use of and experiences in

each gallery: timing and tracking observations, open-ended exit interviews, and focused observations and interviews.

All visitors nine years of age and older were eligible to be unobtrusively observed as they used the components in each gallery. The observed individuals were selected following a continuous random sampling method. In accordance with this method, a trained data collector was stationed at the entrance of the exhibition and five seconds after being in place, selected the first eligible visitor to cross the threshold. The observer followed the visitor through the exhibition, recording components at which the visitor stopped, time spent at individual components, and total time spent in the exhibition. When the selected individual exited the exhibition, the data collector concluded the tracking and then resumed his or her position at the entrance, awaiting the next eligible visitor. A total of 460 visitors were timed and tracked through the galleries.

After visiting each gallery, adults 16 years of age and older were eligible to be selected (following the continuous random sampling method described above) to answer several questions about their experience in a particular gallery. The interview guide was intentionally open-ended to allow interviewees the freedom to discuss what they felt was meaningful. A total of 80 visitors (20 per gallery) participated in an open-ended interview.

Focused observations and interviews were conducted with visitors at five predetermined exhibits. These visitor interviews were cued—that is, visitors were invited to view the specific exhibit and participate in an open-ended interview. A total of 100 visitors (20 per exhibit) participated in an open-ended interview.

All interviews were tape-recorded with participants' awareness and transcribed to facilitate analysis.

DISCUSSION OF FINDINGS

Overall behavioral patterns—The timing and tracking observations provide a thorough examination of visitors' behavioral experiences in all four galleries. While visitors' experiences were highly individualized and the galleries themselves are unique, comparing the findings reveals some general trends.

One way to assess visitors' experiences is to compare the total number of stops visitors made and the total amount of time spent in each of the galleries. Visitors' total number of stops and total time spent in each of the galleries were very similar. Visitors stopped at a median of 7 to 11 components in each gallery: visitors made the most stops in *Life Tech* (median = 11 stops) and the fewest in *Communication* (median = 7 stops). Visitors spent a median time of 14 to 17 minutes in each gallery; they spent the most time in the *Innovation Gallery* (17 minutes) and the least in the *Communication Gallery* (14 minutes).

To better understand the total number of stops visitors made and the total time they spent in the gallery, it is helpful to compare these galleries with other exhibitions of similar size. To make such comparisons, Serrell (1997) used the amount of time visitors spend in exhibitions to calculate the "sweep rate index" (SRI). She also used the

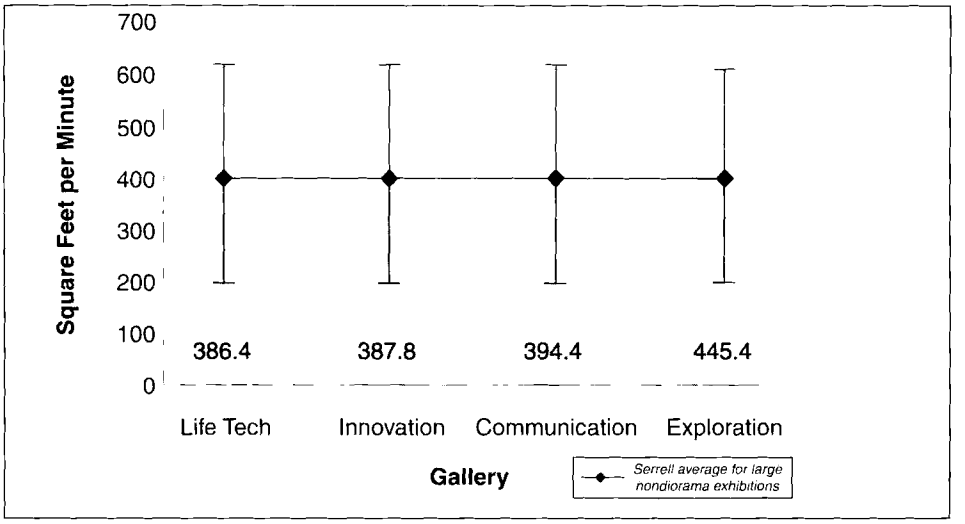

Figure 1. Sweep rate index by Gallery

number of components visitors stop at to calculate the "percentage diligent visitors index" (%DV).

The SRI is calculated by dividing the exhibition's square footage by the average total time spent in the exhibition. The lower the SRI, the more time visitors spent per square foot of space. The SRIs for each gallery are presented in Figure 1. *Life Tech* has the lowest SRI (386 square feet per minute), followed by *Innovation* (388 square feet per minute), *Communication* (394 square feet per minute), and *Exploration* (445 square feet per minute)[1], which are similar to the average SRI Serrell found for large nondiorama exhibitions.[2] According to the SRI, visitors are going through *Life Tech*, *Communi-cation*, and the *Innovation Gallery* at about the same rate as visitors to exhibitions of similar size. Visitors to the *Exploration Gallery* are traveling at a somewhat higher rate (e.g., faster), however, still within one standard deviation of Serrell's average SRI. The vertical lines dissecting the bars indicate the large standard deviation for Serrell's average SRI.

The %DV is obtained by calculating the percentage of visitors that stopped at more than half of the components. The higher the %DV, the more thoroughly the exhibition was used. Figure 2 shows the %DV for each gallery. *Communication* has the highest %DV (7 percent), followed by *Innovation* (6 percent), *Life Tech* (2 percent), and *Exploration* (0 percent). All are lower than the average %DV Serrell found[3], which means visitors stopped at fewer components in each of the galleries, compared to exhibitions of similar size. Again, the vertical lines dissecting each bar indicate the large standard deviation for Serrell's average %DV.

Some developers do not use Serrell's SRI and %DV model as the lens through which to examine exhibitions because this model measures the degree of thoroughness of use of an exhibition, and these developers are more concerned with creating exhibits with high holding time. Additionally, some developers intentionally create exhibitions

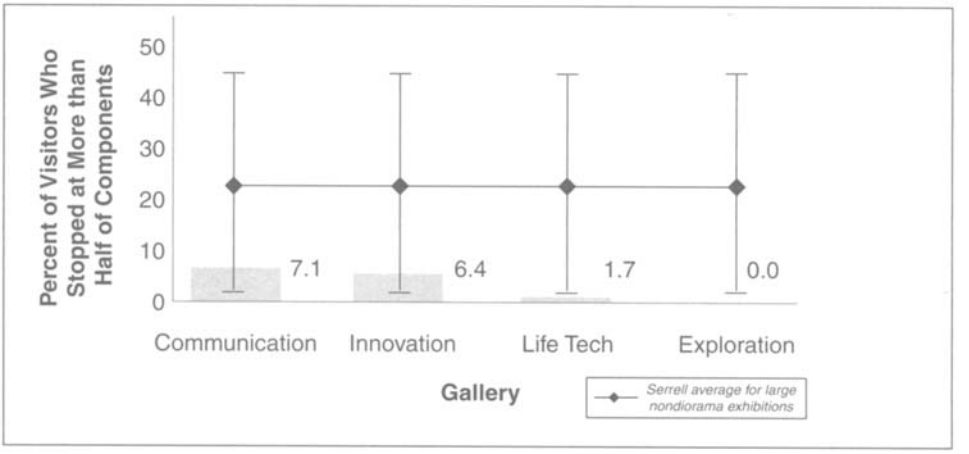

Figure 2. Percent diligent visitor by gallery.

to include a range of component types to appeal to a range of learning styles, which may or may not be compatible with exhibitions being thoroughly used. These developers may expect that visitors will not find the exhibits appealing because many of the elements are designed for just a few really interested or specialized visitors. In all fairness to developers, developers' behavioral objectives are important to consider when discussing the success of an exhibition or %DV, and staff at The Tech admit that articulating behavioral objectives was not part of their development process. Serrell points out that her study methods do not apply to exhibitions where visitors are expected to have in-depth experiences with a few elements (1998). Nevertheless, Tech developers need to decide for themselves if they are content knowing that less than one-quarter of visitors use more than half of what is available to them.

However, if developers would prefer to see a higher %DV, they need to realize that there are some constraints to these methods that might affect the %DV. Clearly, visitors found certain components particularly compelling and chose to spend their time at those components rather than sampling many different ones. In fact, the gallery exit interviews support that visitors spoke highly of the overall interactive quality of the exhibits and then praised a few specific components. In addition, visitors may have intended to visit the gallery again either on the same day or in the future. Because of the nature of unobtrusive observations, data collectors do not know at what point in the subject's visit the tracking is taking place. Furthermore, repeat visitors often have favorite components that they revisit to the exclusion of other components. Repeat visitors may also focus on select exhibits because they know they can always visit again and do not have to see and do everything all at once. According to the findings of the visitor survey (RKA, 2000), about one-fifth of the summer visitors (20 percent) were repeat visitors, a sizeable portion of visitors considering the new building had only been open for about a year at the time of the study. Nevertheless, it is important for developers to think about their own expectations for visitor behaviors.

Exploration's low %DV, in particular, deserves some attention. *Exploration* is the largest gallery of the four and it also has the most components (see Table 1). Serrell (1998) and others (Korn 1993) have found that visitors spend less time in large exhibitions than small ones. For visitors, less is often more, which might be a very simple explanation for *Exploration*'s low %DV. Another way to interpret the low %DV is in terms of the types of experiences *Exploration* offered visitors. *Exploration* has the highest number of panels without artifacts (21 total)—more than twice as many as in other galleries. As evidenced in the findings from each gallery, and in other studies (Korn 1992, 1997), panels without artifacts do not perform well in terms of attracting and holding visitors. *Exploration* also has the lowest number of computer interactives (seven total), which was a popular component type in the other three galleries, both in terms of frequency of stops and amount of time spent. Thus, *Exploration* has many of the component types that visitors tend to ignore (panels without artifacts) and relatively few that visitors tend to like (computers) both of which may have contributed to the low %DV (a more in-depth discussion of use of component types follows).

The low %DV for *Life Tech* (2 percent) deserves some explanation as well. *Life Tech* was the smallest gallery, but it has 65 components—10 less than *Exploration*, but more than the other two galleries. It contains 15 computer interactives and 14 mechanical interactives. More than half of visitors stopped at three or more of these component types, and the median time spent at the computers was 66 seconds and for mechanical interactives, 42 seconds (see Table 2). Stops at the other component types in *Life Tech* were considerably less. Thus, visitors selected to spend their time at a few exhibits rather than sampling a large number. As noted earlier, having more than one-quarter of visitors stop at more than half of the exhibits is not always the model that developers choose for examining exhibition use.

The above discussion presents some general behavioral trends. Further examination of the behavioral data show how visitors move through a space and where they select to stop and spend their time. These use patterns can help draw conclusions about visitors' behavioral experiences and sometimes explain visitors' cognitive experiences, which were described by visitors during the interviews. The next section of this article examines visitation to gallery sections and gallery introductions, and the attraction and holding time of various component types, and is followed by a description of visitors' cognitive experiences.

Visitation of gallery sections—Figure 3 shows that most of the sections were visited by at least half of visitors: all of the sections in *Life Tech*, all but one in *Innovation* and in *Exploration*, and all but two in *Communication* were visited by at least half of visitors. This suggests that the gallery sections contained diverse components that worked together to attract a majority of visitors.

Sometimes attraction power is a function of location, a point illustrated in *Life Tech* and *Communication*. "Perspective" in *Life Tech*, and "Global Networks" in *Communication* are two sections through which visitors enter the galleries, and they attracted the most visitors (see Figure 3). However, location was less of a factor in the

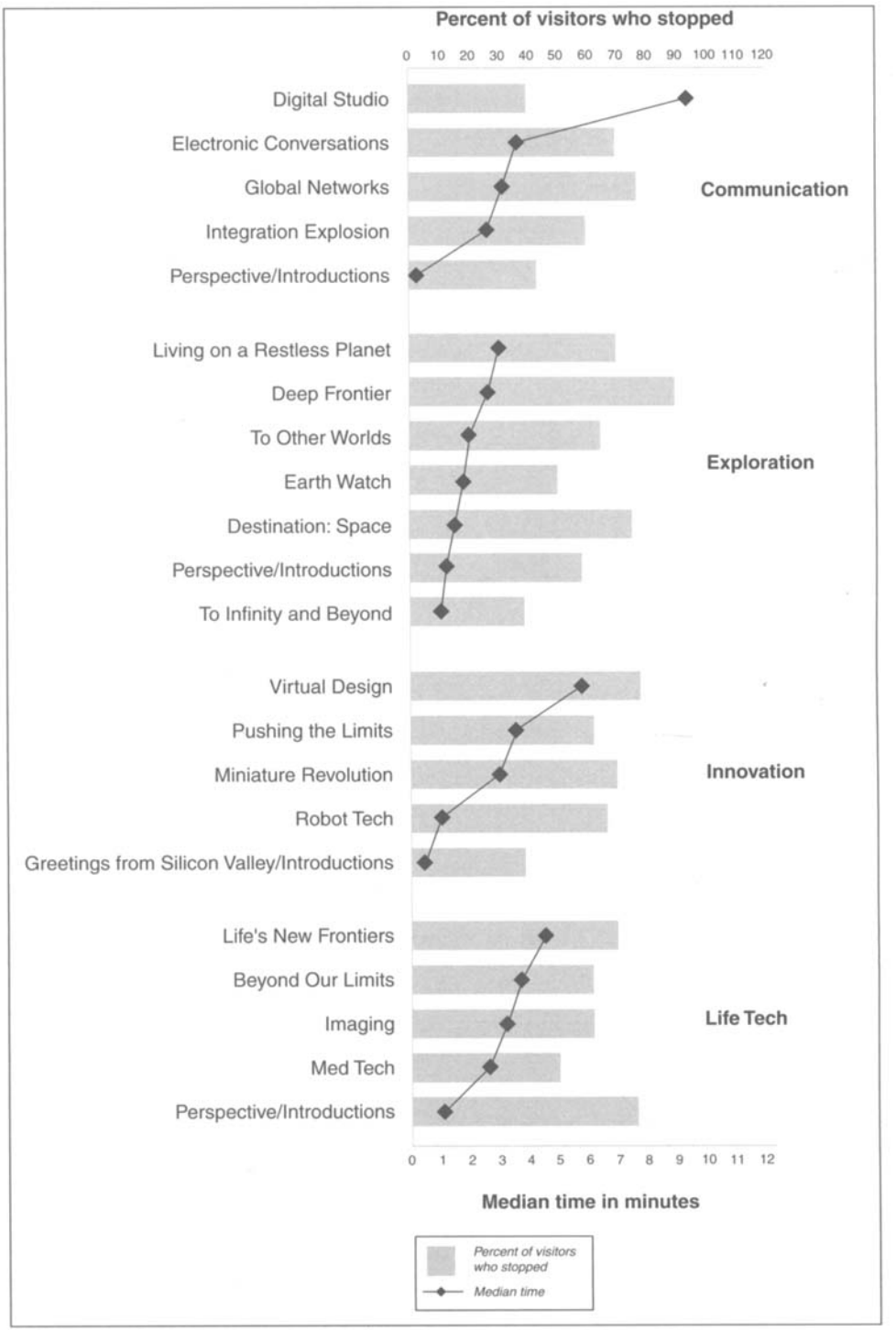

Figure 3. Total number of stops and time spent in each gallery section.

Table 2. Total Number of Stops and Median Time Spent at Each Component Type by Gallery

	Communication			Exploration			Innovation			Life Tech		
Component Type	Number Available	Median Number of Stops	Median Time(sec)	Number Available	Median Number of Stops	Median Time(sec)	Number Available	Median Number of Stops	Median Time(sec)	Number Available	Median Number of Stops	Median Time(sec)
Computer	13	3.0	95	5	0.0	67	7	1.0	62	15	3.0	66
Mechanical	5	1.0	72	18	4.0	28	10	1.0	40	14	3.0	42
Simulation	3	1.0	88	4	1.0	55	2	1.0	66	2	1.0	89
Staffed	1	0.0	65	4	1.0	75	2	1.0	73	2	0.0	79
Ethics	7	0.0	23	2	0.0	33	3	1.0	30	6	0.0	21
Panel with artifact	1	0.0	23	8	0.0	22	7	1.5	60	2	0.0	40
Panel w/out artifact	6	0.0	22	21	1.0	23	8	0.0	10	8	0.0	24

Exploration and *Innovation* galleries. "The Deep Frontier" section in *Exploration* and the "Virtual Design" section in *Innovation* were the most popular sections. One hypothesis for their attraction is the impressive ROV exhibit in "The Deep Frontier" (an underwater remotely operated vehicle in a large aquarium) and the large and popular exhibits in "Virtual Design" (e.g., 3-D scanner—where a laser scanner rotates 360 degrees around your head to capture a 3-D map of your head; and Tech Cyclone—where you design and ride a simulation roller coaster).

The holding time of each gallery section also tells an interesting story. Unlike attraction power, holding time is independent of location. "Digital Studio" (a networked multimedia studio) attracted the fewest number of visitors of all the sections in *Communication*, yet it held visitors for the longest amount of time (median time of over nine minutes). Only one section had both the highest attraction power and holding time: "Virtual Design" in *Innovation* attracted the highest percentage of visitors and was also compelling enough to keep their attention for a median time of six minutes. As noted above, the introduction areas had high attraction, but they had low holding time. In fact, visitors spent less than one minute in the introduction areas to *Communication* and *Innovation*.

Gallery Introductions. Observations show that at least half of visitors stopped in the introduction areas of each gallery. This finding is not surprising considering that introduction areas are located at the entrance of the galleries. Holding time, however, is low—visitors spent a median of about one minute in the introduction areas of *Exploration* and *Life Tech* and less than one minute in those of *Innovation* and *Communication*. More striking is that visitors spent the least amount of time in the introduction area as compared to all other sections (see Figure 3). This is noteworthy, as other studies have shown that visitors spend more time at exhibits in the beginning of their visit and, as fatigue sets in, less time at exhibits near the end of their visit (Falk et al. 1985). Thus, the relatively short amount of time visitors spent in the introduction areas suggests that these areas were not particularly compelling.

During the interviews, visitors were asked if they experienced an area that served as an introduction. Roughly half correctly identified the introductions in *Exploration* ("Explorers' Hands") and *Innovation* ("Postcards from the Edge"), but only one visitor of twenty identified the introduction in *Communication* and two visitor groups out of twenty identified the introduction in *Life Tech* (both are titled "Perspective"). Perhaps "Explorers' Hands" was identified as the introduction by the most visitors, as compared to other introductions, because "Explorers' Hands" is housed in a separate physical space and includes interpretive text to present the main idea of the *Exploration Gallery*. Furthermore, some visitors went on to say that they thought "Explorers' Hands" worked well as an introduction because it provided a lens through which to view the exhibition—which is exactly what an introduction should do for visitors.

Another way to gauge the effectiveness of introduction areas is to examine how visitors articulated the theme of the individual galleries. Some believe that introductions, which are sometimes called advanced organizers (Ausubel 1960), should provide the physical and conceptual framework of the exhibition and introduce the themes of

Figure 4. Clean Room immersive environment, *Innovation Gallery. Photo © The Tech Museum of Innovation, 1999*

the exhibition. Others believe that proper introductions create more comfortable and understandable exhibitions (Griggs 1983). In *Exploration*, for example, almost all visitors named the three primary exploration areas—land, ocean, and space, with about half seeing exploration itself as the unifying theme for land, ocean, and space, and a few seeing the main idea as displaying new information and technology. In contrast, almost half of visitors to *Life Tech* experienced the gallery to be about health and the human body, with a lesser number of visitors making the connection between applying technology to study the human body. Similarly, visitors to *Communication* only gleaned the surface of the content, saying that the gallery was about communication devices. That is, visitors to *Communication* were experiencing the components at face value, without seeing larger ideas behind the components, whereas in *Exploration*, visitors experienced the individual components within the larger theme, perhaps because visitors were cued in to what the larger theme was. There was little agreement among visitors about the primary theme of the *Innovation Gallery.* For example, the "Clean Room" had such a strong effect on some visitors that they thought the gallery was about chip development. For a few others, the gallery was about the latest technological advancements, and some visitors could not identify a theme.

Introductions are only partially responsible for communicating pertinent content; the workings of individual exhibits, how they connect to the larger theme, and how they convey ideas, are other issues that deserve examination.

Figure 5. Med Tech immersive environment, *Life Tech Gallery. Photo © The Tech Museum of Innovation, 2000*

Attraction power and holding time of component types—As noted earlier, there are seven main types of components: computer interactives, mechanical interactives, simulation interactives, staffed exhibits, panels with artifacts, panels without artifacts, and ethics exhibits. Each gallery included at least one of each component type.

All four galleries' mechanical interactives and simulation interactives were popular component types (see Table 2). In each of the galleries, except *Exploration*, computer interactives were also popular component types. The popularity of mechanical interactives and computer interactives may be explained, in part, by the fact that they were plentiful. However, other exhibit components, such as panels without artifacts, were more prevalent in *Innovation*, *Communication*, and *Exploration*, but they were not stopped at as frequently as the interactive components, suggesting that interactives are popular for reasons other than sheer availability. For simulation interactives and staffed exhibits, this is certainly the case, as there were few available (between two and four) in each gallery and yet most visitors stopped at one or more of them.

The popularity of some component types is further substantiated by their holding time. As Table 2 shows, in each of the four galleries, computer interactives and simulation interactives had high holding times—more than one minute each. In fact, visitors who stopped at computers in *Communication* spent a median time of 95 seconds. Even in *Exploration*, where computer interactives had low attraction power, the holding time was still high, as visitors spent a median of 67 seconds. In each of the galleries, except

Communication, staffed exhibits also had high holding time with visitors spending a median time of more than one minute.

In addition to these general trends, there was one noteworthy, gallery-specific finding. In *Innovation*, panels with artifacts were the most popular type of component (visitors stopped at a median of two panels with artifacts) (see Table 2). In addition, panels with artifacts had the highest attraction and had relatively high holding time (median time of one minute). The gallery interview data provides insight to visitors' behaviors. Interviewees reported being fascinated to learn about how microchips are made, indicating that they spent time reading the panels with artifacts in the "Miniature Revolution" section, where the "Clean Room" (clean rooms are where microchips are manufactured) and information about microchip development is placed.

Immersion exhibits—All four galleries include one immersion exhibit. *Exploration* has a planetary base camp; *Communication* has "Chat Connection" cyber café; *Innovation* has a "Clean Room"; and *Life Tech* has "Med Tech" (which is an operating room in a hospital). Staff wanted to know if visitors knew that they were in an immersion environment, and if so, what elements need to be in place for visitors to experience an exhibit as immersive, and whether these immersion environments were effective at conveying content. Data from the interviews provide concrete information related to these questions.

Almost half of visitors who were interviewed after visiting the *Innovation Gallery* did not enter the "Clean Room", but of those who did, nearly all identified the "Clean Room" as the immersion environment. Visitors who knew something about clean rooms felt that it was authentic, from the floor, to the bright lights, to measuring the amount of dust on one's body. Without question, the "Clean Room" was a convincing environment to those who went in it. Many interviewees spoke about the "Clean Room" as an educational experience, saying they learned about chip development and silicon.

"Med Tech" fared nearly as well as did the "Clean Room" in terms of visitors identifying it as an immersion environment, but it was less successful at providing visitors with a content-rich experience. Visitors offered many, many suggestions for enhancing their experience. The vinyl flooring and the dummy on the gurney were convincing, but almost half of interviewees noted that there should be real machines displayed instead of photographs of machines, a brightly lit room with green or white walls, and double-swinging doors for visitors to walk through.

Only one interviewee each thought the "Planetary Base" and "Chat Connection" electronic café were immersion environments.

Clearly, visitors value authenticity, and they seem to be able to recognize when something is authentic. The "Clean Room" was easily discernable as a real clean room, but the other environments were unconvincing fabrications. In other studies conducted by RK&A, visitors have strongly indicated the importance of authenticity, not only in environments that are intended to represent something specific, but in the information that is conveyed to them (RK&A 1994, 1995). "Planetary Base" and "Chat Connection" did not look enough like the environments they were meant to be.

Figure 6. "Virtual Design" area of *Innovation Gallery. Photo © The Tech Museum of Innovation, 2000*

Ethics exhibits—All four galleries include two or more ethics exhibits, which are issues-oriented exhibits. *Life Tech* and *Communication* have six and seven, respectively, and *Exploration* and *Innovation* have two and three, respectively. Behavioral data are revealing. For example, in *Innovation*, the top-performing ethics exhibit was a computer interactive called "Innovation Forum". Visitors would sit in front of a camera and share their opinions about technology and also listen to other visitors' opinions. It attracted 29 percent of visitors. In comparison, the two top-performing ethics exhibits in *Communication* are about privacy issues related to telephones. They attracted 18 percent and 13 percent of visitors.

Two ethics exhibits about privacy issues related to the Internet and wireless in *Communication* were selected for the focused observations and interviews. While nearly all interviewees noted that there was something personally relevant to them, they also said that the content on these panels was not new. While personal relevance is important, so is content, as exhibits must bring visitors to a new place.

Two other ethics exhibits—one about reproductive technology and the other about prolonging life—in *Life Tech* had low attraction power and holding time

(2 percent stopped and stayed for a median of 19 seconds). Both were panel displays. Focused observations and interviews reveal that visitors who read the panels—as they were asked to do in the focused observation and interviews—recognized the difficult issues presented in the panels and praised the interpretive strategy of presenting these issues through stories about people's different experiences. Interviewees said reading about other points of view encouraged them to explore their own point of view, and in some cases, discuss it with their children. The content of "Beginnings and Endings" was compelling for those visitors who decided to read the panels in their entirety.

Exhibits that are about ethical and social issues, it seems, would naturally catch people's attention and cause them to pause, reflect, and think about the ideas because the notion of museums including exhibits that present multiple perspectives of a controversial idea is not a particularly mainstream idea. The surprise of encountering such an exhibit, in and of itself, is a potential attraction feature for some visitors, as was articulated by a few interviewees who participated in the focused interviews. In fact, most interviewees noted that ethics exhibits raise important issues and were in favor of the Museum displaying them. When ethics exhibits do not capture people's attention, one could hypothesize that the location and placement of the exhibit is not advantageous, or that the design of the exhibit—not just the way the exhibit looks, but the component type as well—is not eye-catching.

All the data related to the ethics exhibits suggest content must be aligned with both audience and design. Relevance of information and offering new information are crucial, as is how the exhibit looks, where it is placed, and the selected medium. For example, if the issue is relevant to children's lives, a panel might not attract children, but if the issue is more relevant to adults, text may be a suitable presentation method. If the issue is one that is for adults but can be discussed with children, perhaps the exhibit should include guidance to parents about how to best approach the topic with their children. Likewise, if the issue is a private matter, the exhibit should be in a private space so visitors feel comfortable either using the exhibit or discussing the content with their family.

As suggested above with the reporting of focused interview data, visitor experiences also include cognitive and affective experiences, neither of which is clearly discernable through observational data. In this phase of evaluation, cognitive and affective experiences were collected through visitor interviews. The exit gallery interviews and focused interviews at individual components offer insight into visitors' thoughts about their experiences.

Visitors' thoughts about their experiences—Visitor gallery exit interviews indicate that visitor learning in the *Communication* and *Exploration* galleries was somewhat vague. That is, visitors did not necessarily identify specific ideas that they learned, rather they spoke about being exposed to and interacting with new technologies, and in some cases, experiencing a new phenomenon such as an earthquake. Additionally, seeing what is not normally visible to the naked eye proved to be an exciting part of visitors' learning experiences.

In *Life Tech* and *Innovation*, however, visitors had a different kind of learning experience. In *Life Tech*, visitors recalled specific facts that they had gleaned from some of the exhibits, likely because those facts were about health and the human body, a relevant topic for all visitors. Just as visitors to *Exploration* and *Communication* liked being able to see the inside of technological machines, visitors to *Life Tech* liked being able to see parts inside the human body. In *Innovation*, the "Clean Room" and workbenches (tabletop, hands-on mechanical exhibits where visitors were able to experiment with technological devices like lasers and electrical circuits) affected visitors' learning experiences. For example, visitors were very excited to learn about chip development and enjoyed seeing a real "Clean Room." Others liked the step-by-step experiences that the workbenches offered. While visitors could not actually identify what they had learned from the workbenches, they felt like they were involved in the learning process.

While visitors' learning experiences were broad-based, the objectives for each gallery, as stated in each gallery's Exhibition Plan (see Table 1), are specific and content-based. Typically, museum practitioners think about conveying particular ideas and information when they set out to develop an exhibition, and in the best of all possible worlds, exhibitions are executed with the intention of presenting those ideas. Many seasoned evaluators and practitioners advocate developing exhibitions that have one broad idea (Serrell 1996), and they recommend that all the exhibits within the exhibition relate back to the primary idea. So, ultimately, the specific objectives need to be cohesive, and the individual exhibits need to reflect those objectives.

NEXT STEPS FOR THE TECH

This phase of evaluation provided a wealth of action-oriented information that staff members swiftly embraced. There were two significant findings in this first phase of evaluation. One was that visitors were not grasping the essential messages of the galleries—messages that staff members believe are essential. Second, visitor behavior indicated why visitors did not grasp some of the essential messages. In some ways it makes sense that visitors were not grasping essential messages, considering how few components were visited in any one gallery, and that the introduction areas were not performing optimally (e.g., visitors were not spending time at them, and they did not always convey the gallery's important ideas). If staff members consider visitor behavior (visitors spend time at a few of the many components), they can begin the process of reexamining the content of and experience offered by each exhibit to make sure the message is accessible—even if visitors select to use just a few exhibits.

It is easy to see why thorough use of an exhibition is a desirable outcome, as Serrell points out; especially if staff strive to provide visitors with a holistic exhibition experience—rather than isolated component experiences. The challenge of providing a holistic experience is great when exhibition components hold visitors' attention for relatively long periods of time, when visitors visit few components, and when there is a

saturation point in terms of overall time spent in a hall. Is it possible for visitors to have a holistic experience when they use few components? Can visitors piece together a larger "big idea" from seemingly disparate exhibits that are often experienced at face value? Herein lies the challenge for The Tech.

Each new museum under planning always strives to be different from the rest, and according to the behavioral data, The Tech is different—that is, visitors are behaving differently at The Tech compared to other museums. Visitors are attentive to their tasks and they are spending time on task, and frenetic behavior is less visible in galleries at The Tech, compared to behaviors observed in other science exhibits (Korn 1993). On the surface, these behaviors are a welcome reprieve; they are behaviors that parents and teachers want to see. However, The Tech falls a little short in the area of offering visitors rich cognitive experiences. To their credit, though, staff members have mobilized to address this problem with tremendous passion, dedication, and enthusiasm. They have publicly declared that their museum is a work in progress (The Tech Museum of Innovation Strategic Plan 2000–2004, 2000; Korn 2000).

At the writing of this manuscript, four separate teams just have completed reviewing each gallery component to make sure it is connected to each gallery's newly crafted big idea. As most developers will admit, returning to a project that took years to develop is difficult. But The Tech is determined to create an effective and educational visitor experience. Its challenges, as a young institution, are many, but Phase I of the evaluation has clarified at least one challenge: considering visitors' inclination to visit relatively few exhibit components in each gallery, can the exhibits be altered to help visitors experience a big gallery idea when the experience of individual components is so strong? The Tech believes that individual exhibit components should not be solely responsible for enhancing visitors' understanding of the galleries' big ideas, but that all staff—paid and unpaid—share that responsibility. Across departments, staff are developing new programs and tweaking existing ones to align them with the big ideas, and staff are being trained to guide visitors' interactions with exhibits, with the goal of articulating and demonstrating gallery objectives and big ideas. Evaluation for The Tech has given them concrete information on which to act, and with grace and passion, they are moving forward. The second of six guiding principles in their Strategic Plan 2000–2004 is "We are committed to research and evaluation to determine audience and community learning needs and the effectiveness of our exhibits and programs in meeting those needs." The first strategic initiative (of four) is to "Enhance the quality of The Tech's learning experiences with integrated content, services, and teaching methods to attract and wow new and repeat visitors." The next evaluation is slated for 2002.

REFERENCES

Ausubel, D. 1960. The use of advance organizers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology* 5: 267–72.

Falk, J. H., Koran, J. J., Dierking, L. D., and Dreblow, L. 1985. Predicting visitor behavior. *Curator: The Museum Journal* 28: 249–57.

Griggs, Stephen. 1983. Orienting visitors within a thematic display. *International Journal of Museum Management and Curatorship* 2: 386–93.

Randi Korn & Associates, Inc. 1992. *Treasures from the Sand: An Evaluation* (unpublished manuscript). Colonial Michilimackinac, Mackinaw City, MI.

—— 1993. *The Living World: An Evaluation* (unpublished manuscript). The St. Louis Zoo, St. Louis, MO.

—— 1994. *An Evaluation of the Becoming Americans Theme* (unpublished manuscript). Colonial Williamsburg Foundation, Williamsburg, VA.

Randi Korn. 1995. An analysis of differences between visitors at natural history museums and science centers. *Curator: The Museum Journal* 38/3: 150–60.

Randi Korn & Associates, Inc. 1997. *Electric Space: A Summative Evaluation.* (unpublished manuscript). Space Science Institute, Boulder, CO.

—— 2000. *Whole Museum Experiences: Findings from Exit Interviews, Surveys, and Post-visit Telephone Interviews* (unpublished manuscript). The Tech Museum of Innovation: San Jose, CA.

Melton, A. 1933. Some behavior characteristics of museum visitors. *Psychological Bulletin* 30: 720–21.

Serrell, B. 1996. *Making Exhibit Labels: An Interpretive Approach*. Walnut Creek, CA: AltaMira Press, a division of Sage Publications, Inc.

—— 1997. Paying attention: the duration and allocation of visitors' time in museum exhibitions. *Curator:The Museum Journal* 40/2: 108–25.

—— 1998. *Paying Attention: Visitors and Museum Exhibitions*. Washington, D.C.: American Association of Museums.

The Tech Museum of Innovation Strategic Plan 2000–2004. 2000. San Jose: The Tech Museum of Innovation.

NOTES

1. The *Life Tech Gallery* is 7,870 square feet; the average (mean) total time spent in the gallery was 20.37 minutes. *Innovation Gallery* is 8,252 square feet; the average total time spent in the gallery was 21.28 minutes. The *Communication Gallery* is 8,113 square feet; the average total time spent in the gallery was 20.57 minutes. *Exploration Gallery* is 8,306 square feet; the average total time spent in the gallery was 18.65 minutes. The average total times were used in the SRI calculation in accordance with Serrell's methods. Throughout the rest of this paper, the median times are reported, as the median is standard for time data that is unevenly distributed across its range.

2. Serrell reports an average SRI of 400.5 (191.5) for large (>3,900 square feet) non-diorama exhibitions.

3. Serrell reports an average %DV of 23.4 percent (20.4) for large (>3,900 square feet) nondiorama exhibitions.