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The Effect of Broken Exhibits on the Experiences of Visitors at a Science Museum

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ABSTRACT

This study explores visitors' perceptions of "broken" exhibits at the Museum of Science, Boston. Data were collected through comment cards, timing and tracking maps, exit interviews, surveys, and focus groups. Analysis of the data shows that the number of broken exhibits a visitor perceives impacts their disappointment in the gallery more than Museum counts of broken exhibits. The perceived broken exhibits follow a hierarchy. They are most often reported when they are non-functional. Partially functioning exhibits and design issues (such as poor usability and missing or incorrect information) are also reported, but less frequently. Pine and Gilmore's *Field Guide for the Experience Economy* (2005) is used as a framework to interpret the findings. Suggestions are made for ways of decreasing the effect of broken exhibits on visitor experiences.

Interactive exhibits have become ubiquitous in science museums around the world. The hands-on nature of interactive experiences makes them ideally suited for engaging visitors in the process of science discovery and inquiry. Recently, other types of museums, including art, history, and children's museums, have also discovered the benefits of interactive exhibits and have added them to their exhibit repertoire.

Despite the positive aspects of interactive exhibits, they can be hard to maintain. McLean (1993, p. 99) stated, "Interactive exhibits require a maintenance staff to keep them going, no matter how well they are designed and built. Anything that moves in an exhibit requires more maintenance and care than inanimate exhibits, and the more moving parts, the greater the possibility of breakdown." If interactive exhibits are more likely to become broken than static exhibits, then visitors attending museums that contain interactives are likely to encounter broken exhibits during their visits. The question then, is how broken exhibits affect visitors during their time at the museum and if visitors' experiences can be improved without removing all the broken exhibits within a museum's walls.

Prior research has tried to determine how design, museum response to broken exhibits, and percentage of uptime affect visitor reactions to exhibits. Oker (1992,

p. 166) explained that poor design can cause maintenance problems: "Lots of moving parts can mean trouble (printers, video tape players, etc.); items that require care and feeding are tough for most museums to keep up with (e.g., printers that require ribbons, paper, and un-jamming); and industrial equipment is often more reliable than consumer equipment (but sometimes it's just more expensive)." In addition, computer software needs to be well designed because "a poor interface will be perceived as a broken program" (Oker, 1992, p. 167). Even if design does not bring about maintenance problems, it can cause visitors to feel than an exhibit is broken. Gutwill (2001) found that almost half of the visitors interviewed at The Exploratorium in San Francisco encountered a "challenging" exhibit they could not get to work. Even though many of these exhibits were working, a small percentage of the people in the study remarked that they felt the exhibit was broken and therefore moved on when they encountered it.

Studies have also explored ways museums can control visitor reactions to broken exhibits. Gutwill (n.d.) investigated visitor responses to various broken exhibit signs and found that visitors showed no preference for any of the signs. However, this does not mean that broken exhibits are not important to visitors. A summative evaluation conducted by Randi Korn & Associates, Inc. (2000, p. 21) for The Tech Museum of Innovation found that three-quarters of visitors reported encountering broken exhibits, and one-quarter of visitors "were disappointed because there were broken exhibits." Visitors were upset in spite of the fact that "during the study, each gallery contained between one and eight broken exhibits" which was not a high percentage of the exhibits (Randi Korn & Associaties, Inc., 2000, p. 21). Since the report, The Tech Museum has made it a priority to keep the uptime of exhibits at 95% (Wageman, 2001a). The museum has also found that keeping 50 "high-impact exhibits" working at an even higher level is critical to visitor satisfaction (Wageman, 2001a). In order to camouflage broken exhibits, Wageman (2001b) suggested removing signage and buttons that do not work, presenting programs in front of broken exhibits to distract attention from them, turning broken exhibits into a learning experience, offering extra programming, or training staff to direct visitors to similar exhibits.

These studies cover a number of aspects important to understanding the issues surrounding broken exhibits. However, none of these articles addresses the matter of how broken exhibits affect visitors. One way to evaluate a museum visit from the visitor perspective is as an experience. Pine and Gilmore (1999a, p. 46) defined experiences as "memorable events, revealed over time, that engage individuals in an inherently personal way." They explained, "Experience stagers must . . . eliminate anything that diminishes, contradicts, or detracts from the theme" or risk ruining visitors' attitudes about their visit (Pine & Gilmore, 1999b, p. 55).

In an effort to understand how to decrease negative feelings about broken exhibits and increase visitors' enjoyment, this study seeks to answer two questions:

1. How do broken exhibits affect visitor experiences?
2. What types of broken exhibits most negatively affect visitor experiences?

This information will inform exhibit design decisions and allow museum professionals to determine maintenance priorities.

Table 1. *Study gallery opening dates and exhibit types*

Gallery	Opening date	Exhibits types
Seeing the Unseen	November 18, 1991	Computers/Activities
Investigate!	March 9, 1996	Computers/Activities
Messages	May 27, 1999	Computers/Activities
Natural Mysteries	May 23, 2000	Computers/Activities/Static Objects
Making Models	June 26, 2003	Computers/Activities/Static Objects

METHOD

Data were collected at the Museum of Science, Boston in 2005. Multiple methods were used to allow triangulation of the data regarding broken exhibits and create a full picture of visitor experiences. By using triangulation, biases resulting from the use of a single instrument were lessened because data were compared across instruments (Patton, 2002).

Selection of Study Galleries

The galleries used in this study represent a range of ages and exhibit types found at the Museum of Science, Boston. The five study galleries are *Seeing the Unseen, Making Models*, *Investigate!*, *Natural Mysteries*, and *Messages*. As indicated in Table 1, the galleries varied in age from 2 to 14 years at the time the study was conducted, and exhibit types included computers, static objects, and non-computer hands-on activities.

Evaluator Determination of Broken Exhibits

The Museum of Science evaluator worked closely with senior members of the Exhibit Hall Operations Department to learn how the Department assesses the maintenance status of exhibits. The maintenance worker described their protocol as follows: check all buttons and audio for functionality; check computers for operating speed and program bugs; check activities to make sure they have the required pieces; and check for damaged graphics. The protocol of the Exhibit Hall Operations Department was followed by the evaluator as a way of determining if visitors were examining the functionality of exhibits in the same way as the Museum.

Selecting Study Participants

Over the course of the study, 225 visitors and Museum volunteers took part in the timing and tracking, exit interview, visitor survey, and focus group studies (Table 2). Many others participated by filling out comment cards, but their numbers are unknown because evaluators did not control the collection of comment cards. Participants who provided data in ways other than through the comment cards were at least 7 years old, and most were 20 years or older. This population was chosen because it was felt that these visitors would be more concerned about broken exhibits, and because the adult visitor serves as the primary decision-maker regarding whether a family will visit the Museum of Science.

Comment Card Report Protocol

Comment card reports from January 1 to November 15, 2005 were analyzed for the study because this is the method through which Museum of Science visitors normally

Table 2. *The number of study participants for each data collection instrument*

Instrument	*Seeing the Unseen*	*Investigate!*	*Messages*	*Natural Mysteries*	*Making Models*	Total
Timing and tracking maps	50	0	0	0	58	108
Exit interviews	25	25	25	25	25	125
Visitor surveys	4	9	13	0	16	42
Focus groups	4	5[a]	16	0	14	39

[a]The number of volunteers who participated in an *Investigate!* focus groups was not recorded, so this number is inaccurate.

report problems with exhibits. Though these comments do not represent the thoughts of all visitors, they were the only way, before this study, that the Exhibit Hall Operations Department received information about how visitors feel about broken exhibits. Therefore, it was important to study the comment cards to learn what these particular visitors felt were the major maintenance problems around the Museum.

Although comments from visitors cover a range of subjects, only the comments about broken exhibits were analyzed. Comments were sorted using inductive coding analysis to gain a clearer understanding of why visitors call exhibits in the Museum broken. Inductive coding involves closely examining data to discover tendencies or topics common across many data points (Patton, 2002). The gallery and specific exhibit the comment referred to were recorded, if possible, to determine whether specific exhibits or galleries were reported more frequently.

Timing and Tracking Map Protocol

At least 50 timing and tracking maps were collected for each of two study galleries: *Making Models* and *Seeing the Unseen*. Maps were not collected in the other study galleries because of time constraints. If the Museum was busy, then every third person who fit the criteria (visitors over the age of 12) and crossed an invisible line at the gallery entrance was selected for observation. If the Museum was not busy, then the first person who fit the criteria and entered the gallery was selected. The evaluator recorded when the subject interacted with an exhibit (touched a button, listened to the audio, etc.) or stood in front of an exhibit for 10 seconds. As the subject left the gallery, he/she was approached and asked to answer an exit interview. Exhibits were checked for functionality before any maps were collected, approximately every 45 minutes to one hour during data collection, and at the end of each data collection session.

Timing and tracking maps were collected to determine if visitors interacted with more broken exhibits than would be expected by chance. In addition, evaluators checked whether visitors reported every broken exhibit they encountered on exit interviews. Data were analyzed quantitatively using descriptive statistics.

Exit Interview Protocol

Exit interviews were conducted in all five study galleries (see Appendix A). Twenty-five visitors were interviewed per gallery yielding a total of 125 for the whole study. The protocol for choosing participants was similar to the one used for the timing and tracking study. Visitors over the age of 12 were selected at random as they left the gallery. Every

third eligible visitor who crossed an invisible line was chosen if the Museum was busy, and the first qualified visitor was chosen if the Museum was not busy. If the visitor agreed to participate, the evaluator allowed the visitor to fill out the first page of the interview on their own and then asked a few additional questions about the specific broken exhibits they encountered in the gallery. In *Making Models* and *Seeing the Unseen*, interviewed visitors represent a subset of those who were tracked and timed. As with timing and tracking, exhibits were checked for functionality before, during, and after each data collection session.

Exit interviews were collected to find out the numbers and types of exhibits visitors leaving a gallery would call broken. In addition, the interview posed questions about visitors' disappointment in the number of broken exhibits in the gallery. Descriptive statistics were used to summarize visitor perceptions of, and disappointment with, the number and types of broken exhibits in the galleries. Inductive coding was used to analyze the qualitative data and discover trends in why visitors called exhibits broken.

Visitor Survey and Focus Group Protocol

Forty-two people were invited to the Museum by the Research and Evaluation Department to complete a survey in one of the test galleries and participate in a focus group (see Appendix B). Participants included exhibit hall volunteers, Museum of Science members, high school students who come to the Museum regularly as part of a school program, and an alumni association. These groups were chosen because they represent visitors most (Museum volunteers and members) and least (high school students and new visitors) familiar with the Museum. Most participants were over the age of 20 except for the high school students who were 15–16 years of age.

Participants were asked to test the functionality of all the exhibits in one of the study galleries. If they thought an exhibit was broken, they were asked to mark the exhibit on the survey and write down how they determined it was broken. The process took 30 minutes to one hour, after which most of the survey participants were asked to take part in a 30-minute focus group discussion. The purpose of the focus group was to gain a deeper understanding of visitors' feelings about broken exhibits and to talk to the participants about their criteria for determining what is broken. Because of the long participation time, these participants were invited to the Museum of Science specifically to take part in the study. In return for completing the survey and focus group, the participants were given a small token of appreciation.

Visitor survey and focus group data were collected to learn what visitors would identify as broken if they were given the time to thoroughly examine a gallery and think about the maintenance problems they found there. Visitor survey and focus group data were analyzed using inductive coding methods.

RESULTS

Results from the various data collection instruments are described in the sections below. The results from the timing and tracking maps and exit interviews have been combined because a subset of participants took part in both of these procedures. Data from the visitor surveys and focus groups have been combined for the same reason.

Comment Card Reports

From January to November 2005, 42 of the 301 comment cards (14%) contained remarks about broken exhibits making the topic second in frequency only to visitor service. In addition, it was found that many of the visitors' comments about broken exhibits expressed negative feelings about the Museum. Comments indicative of these feelings include, "We were extremely disappointed since most of the interactive exhibitions and the design activities with the Robots did not work."

Broken exhibit comments on comment cards were further categorized by gallery to see if any areas of the Museum caused more problems for visitors than others. It was found that broken exhibits were not confined to any specific gallery but were spread throughout the Museum. Furthermore, many visitors did not mention specific exhibits or galleries in their comments at all. These comments expressed thoughts like, "Too many exhibits weren't working when I last visited."

The final way visitors' comments were categorized was according to the types of problems that prompted visitors to report exhibits as broken. Most of the broken exhibit comments involved exhibits in need of repair. Another group of comments referred to the design of the exhibit. One of these comments explained: "Fresh water habitat birds' display has lots of errors [on the labels]."

Timing and Tracking Maps and Exit Interviews

How Often Visitors Interact with Broken Exhibits

Timing and tracking studies took place in the *Making Models* and *Seeing the Unseen* galleries. It is expected that the percentage of broken exhibits that visitors interact with would be similar to the percentage of broken exhibits in the gallery. This was the case in *Seeing the Unseen* ($n = 50$). In *Seeing the Unseen*, the mean downtime was 9.8% ($SD = 3.3\%$), and the mean percentage of exhibits visitors interacted with that were broken was 10.0% ($SD = 12.0\%$). A paired-samples t test shows that there was no difference between the percentage of broken exhibits each observed visitor interacted with and the percentage of broken exhibits in the gallery at the time. This is not the case for *Making Models* ($n = 57$) where the mean downtime was 14.1% ($SD = 1.5\%$), and the mean percentage of broken exhibits that the visitors interacted with was 20.5% ($SD = 21.0\%$). A paired-samples t test, $t\ (56) = -2.1$, $p = .024$, indicates that the difference between the percentage of broken exhibits that each visitor interacted with and the percentage of broken exhibits in the gallery was significant, and that visitors interacted with a higher percentage of broken exhibits than would be expected. Of the 59 exhibits in *Making Models*, 14 were broken during the course of observations. Nine of these exhibits were visited by less than a quarter of tracked visitors suggesting that broken exhibits are not more likely to be visited because of their attracting power. Therefore, there must be some other reason why visitors to *Making Models* are interacting with more broken exhibits than expected (some possible reasons for this are suggested in the *Discussion*).

Why Visitors Call Exhibits Broken

The key to whether a visitor called an exhibit broken was functionality. Visitors most often identified problems that made an exhibit non-functional but missed maintenance problems that left an exhibit partially functional. Thus visitors did not find most of the maintenance issues in the study galleries. Of the 20 exhibits that visitors identified as

having maintenance problems, most (16 exhibits) had no function and only a few (four exhibits) had partial function. An additional 49 exhibits with maintenance problems were not identified as broken by visitors. Of these, most (46 exhibits) were partially functional and only a few (three exhibits) were non-functional. A chi-square test of the data, $\chi^2(1, N = 20) = 26.8$, $p = .000$, reveals that the interviewed visitors discovered fewer partially functional and more non-functional exhibits than expected.

Sometimes problems other than functionality caused visitors to think that an exhibit was broken. In *Making Models*, the "What Time Is It?" exhibit allows visitors to replicate stage lighting. One visitor called this exhibit broken because "no lights [were] on." In fact the exhibit was operational but the previous visitor had turned down the lights. In another case, a visitor said that "A Visual Language" video was broken because "the screen was blank," even though the blank screen was only the resting state for the video. Overall, 10% of "broken" comments on exit interviews concerned the exhibits' designs.

Difficult to use exhibits were also called broken by some visitors. One exhibit that some visitors had a hard time operating and understanding was the "Pulley Pit Station" in *Investigate!*. One visitor said of the exhibit, "Pulley—turn it and it seems to be off track. It's a struggle to get it to work." This exhibit was designed to show visitors the efficiency of different types of pulley systems. One pulley requires less work than the other. However, visitors seemed to equate this extra work with a broken exhibit. In this example, not only did visitors think the exhibit was broken, but it is also evident that visitors did not understand the main idea of the exhibit.

Differences between Galleries

Overall, the mean percentage of exhibits identified as broken ranged from 0.6% (*Making Models*) to 5.5% (*Messages*, see Table 3) per interview. The mean downtime for exhibits during the course of observations ranged from 10.1% (*Seeing the Unseen*) to 38.1% (*Investigate!*) indicating that visitors were missing many of the broken exhibits in the galleries. Nevertheless, the mean percentage of exhibits called broken and the mean downtime of exhibits in the gallery still follow the same pattern. The only exception is *Seeing the Unseen* where the mean percentage of exhibits called broken that did not have maintenance problems ($M = 0.6\%$, $SD = 1.0\%$) exceeded the mean percentage called broken that had actual maintenance problems ($M = 0.5\%$, $SD = 1.0\%$). One of the reasons for this was that a lot of people were calling working exhibits broken because of issues concerning their design.

Visitor Disappointment in the Number of Broken Exhibits

The disappointment that visitors feel in the number of broken exhibits seems to be an important indicator of their feelings about their experiences at the Museum of Science. A Likert scale question asked visitors to rate the statement "I was disappointed in the number of broken exhibits in the gallery" on a scale of 1 (*strongly disagree*) to 10 (*strongly agree*). Visitors were most disappointed in the number of broken exhibits in *Investigate!* ($M = 4.7$, $SD = 2.7$). The mean disappointments for *Messages* ($M = 2.6$, $SD = 2.3$) and *Seeing the Unseen* ($M = 2.3$, $SD = 1.9$) were also high. In the other two galleries, the average visitor disappointment was lower: *Making Models* had a mean of 1.7 ($SD = 1.2$), and *Natural Mysteries* had a mean of 1.6 ($SD = 1.1$). An analysis of variance shows that the effect of the gallery on disappointment in the number of broken exhibits was significant,

Table 3. *Mean % of exhibits visitors called broken per exit interview compared with the mean gallery downtimes*

Gallery	Total number of gallery exhibits	Mean % of exhibits called broken	*SD*	Mean downtime of exhibits	*SD*
Seeing the Unseen	54–55[a]	1.1%	1.3%	10.1%	3.1%
Investigate	35	5.5%	5.7%	38.1%	4.4%
Messages	21	3.8%	4.8%	30.3%	3.6%
Natural Mysteries	69	0.8%	1.2%	14.3%	3.1%
Making Models	59	0.6%	1.3%	14.2%	1.5%
Total	239	2.4%	3.9%	21.4%	11.3%

[a] For half of the study, *Seeing the Unseen* had 54 exhibits, and for the other half, it had 55 exhibits.

$F\,(4, 114) = 10.59$, p=.000. Post hoc analyses using the Scheffe criterion for significance indicate that the mean was significantly higher for *Investigate!* than the other four study galleries.

Results of a linear regression analysis, $R^2(116) = 0.502$, $p = .000$, indicate that the percentage of actual broken exhibits, and the percentage of broken exhibits identified by visitors, are predictors of visitor disappointment in the number of broken exhibits in a gallery, the latter being the stronger predictor.

Visitor Surveys and Focus Groups

Visitor survey and focus group data were collected to gain information about how a visitor, who spends a prolonged time in one of the study galleries using most of the exhibits and having thorough interactions, feels about broken exhibits in that gallery. The visitor survey asked the participants to specify if an exhibit was broken and how they determined it was broken. The focus groups allowed these participants to discuss what they thought about the galleries and how they felt about the broken exhibits they found there or might find in other parts of the Museum.

Exhibits that were non-functional and obviously broken were most likely to be called broken by participants on surveys. Other problems found by participants included issues deep within computer programs discovered through protracted interaction. In one case, for example, the participant found that, "messages don't come up (within 5 minutes)." Another common problem identified on the surveys was that the exhibit was working, but the visitors' expectations of the exhibit were not being met. A good example of this problem was discovered by participants using the "*Messages* Web Site/6 Degrees of Separation" computer in *Messages*. A Museum member called this exhibit broken because there was "no sound [coming out of the speakers]. Also, [the] display requires awkward scrolling." The exhibit was working correctly, and no sound was meant to come out of the speakers. However, the participant did not know this and because their expectations were not met, they considered it broken.

The seven focus group discussions focused on the broken exhibits participants identified in the gallery, the criteria visitors used to identify broken exhibits, and the extent to which broken exhibits negatively affected their experiences in the gallery. Participants generally repeated the information that they reported on the surveys. However, one additional topic emerged during the focus groups: problems with buttons and audio.

Participants from many of the focus groups indicated that they had to repeatedly press buttons to get certain exhibits to work, and how sometimes buttons did not elicit a response at all. One participant talked about button problems she found in *Investigate!*: "'How do objects fall?' [Computer I] had to press that button 10 times to get it to work. With hyper kids that would work, but not with other people" (High School Focus Group). Audio was also talked about during the groups because it was too loud or too soft, volume could not be controlled, and it could be "staticky."

> When we were alone in the exhibit [*Messages*], you could easily hear, but when it got busier, things were harder to hear. The hearing cups were helpful. Some of us mentioned headphones. It would be good if future exhibits had them for when it gets busy. They would be easy to maintain. I think in one area, make sure the audio is audible. When the exhibit got too loud, I couldn't hear at all in the audio piece. (Member Focus Group)

This problem could be even greater for persons with disabilities who rely solely on audio to receive content (Reich, 2005). Bugs or design issues were also commonly mentioned. One example brought up was that computers were slow because of their age. "No fun to go up to stuff that's slow. If it's 1990s technology, it's got to go right into the Charles [River]. It's fine if it's fast, but one person in 1800 is going to wait" (Member Focus Group).

As indicated on the comment cards, a few of the focus group participants were unhappy with the number of broken exhibits or felt that if a lot of broken exhibits were encountered they would feel frustrated. One Museum visitor said, "If [broken exhibits were] consistent, I would feel that I wasted my time [coming to the Museum]." She also said, "If I saw a lot [of broken exhibits], I'd have a more negative attitude about the Museum" (Alumni Focus Group).

DISCUSSION

This study suggests that encounters with broken exhibits often leave visitors disappointed and frustrated. However, museums can lessen the impact of broken exhibits by focusing on the maintenance problems that most affect visitors' experiences.

How Do Broken Exhibits Affect Visitors' Experiences?

Timing and tracking studies were conducted in two of the galleries to investigate whether visitors pay more attention to broken exhibits than would be expected by chance. The data is inconclusive. In *Seeing the Unseen*, visitors interacted with a percentage of broken exhibits that was not different from the percentage of broken exhibits in the gallery. In *Making Models*, however, the average visitor interacted with a higher percentage of broken exhibits than the percentage of broken exhibits in the gallery. There are a number of possible explanations for this. First, many of the exhibits in *Making Models* were static objects, and it is possible that visitors were more attracted to the interactives in the gallery, which were often broken. Second, this may be a sign that if gallery downtime reaches a certain threshold, visitors will interact with more broken exhibits than expected by chance. Third, the data may give evidence for a theory expressed by Wageman (2001b) that if a gallery is busy then visitors will be more likely to interact with broken exhibits. (At the time the data was collected, *Making Models* was in a higher traffic area of the Museum than *Seeing the Unseen*). The lack of a definitive conclusion in regards to what made broken exhibits more attractive than working exhibits

in *Making Models* but not in *Seeing the Unseen* suggests that the attractiveness of broken exhibits is a potential area for further investigation.

The impact that broken exhibits had on visitors was explored through the exit interviews, comment cards, visitor surveys, and focus groups. Across data collection instruments, it was found that the broken exhibits had a negative impact on visitors' perceptions of the Museum of Science. According to Pine and Gilmore (1999b, p. 96), to improve the visitor experience and create a lasting positive impression, there need to be "concerted and fruitful efforts to drive up customer satisfaction and drive down customer sacrifice." Pine and Gilmore (2005, p. 3) defined customer satisfaction as "the gap between what customers expect and what they perceive they get," and customer sacrifice as "the gap between what customers settle for and what they want exactly." The data suggest that broken exhibits reduce visitor satisfaction, and increase visitor sacrifice. As a result, visitors pass negative judgment on the Museum when they perceive too many broken exhibits. One visitor, on his comment card, summed up the problem.

> Far too many of the kids' hands-on exhibits are in poor repair. Many of the exhibits in the playground, for example, are not functioning properly. This compares very poorly to other science museums I have attended. It seems more money should be spent on maintenance.

Another visitor comment card said, "So many of the exhibits were out of order and not working. We were disappointed we came all this way, repair your exhibits please!!" These comments illustrate that paying customers expect a high quality product—which includes working exhibits. If their expectations are not met, then their experience is diminished.

The relationship, as indicated through the linear regression analysis, between the percentage of broken exhibits in a gallery reported by visitors and recorded by evaluators and visitor disappointment in the number of broken exhibits is not surprising considering other studies have demonstrated that it is important to control the level of broken exhibits in a museum to decrease visitor complaints (Randi Korn & Associates, Inc., 2000; Wageman, 2001a). The finding that the percentage of broken exhibits found by evaluators was not as strong a predictor of visitor disappointment as the percentage of broken exhibits reported by visitors, indicates that visitor criteria for broken exhibits are critical in managing visitor satisfaction.

What Types of Broken Exhibits Most Negatively Impact Visitor Experiences?

Pine and Gilmore (2005, p. 5) explained in their *Field Guide for the Experience Economy* that "experiences are intrinsically sensory." It is through the senses that visitors will experience a museum, and "the sensory stimulants that accompany an experience should support and enhance its theme" (Pine & Gilmore, 1999b, p. 59). Broken exhibits detract from the theme by creating negative cues. However, by following the patterns established by visitors through the data, a list of priorities can be created that, if followed by those who maintain and create exhibits, should improve visitor experiences.

Issue # 1: Visitors are more concerned with functionality than other maintenance problems

Visitors are most likely to notice an exhibit is broken when it is non-operational. Of the exhibits called broken by visitors on exit interviews, nearly half were non-functional. However, the importance of functionality is most apparent when comparing the number

of broken exhibits found by visitors to those found by evaluators. Overall, visitors only missed a small number of the non-functional exhibits found by evaluators whereas they missed almost all of the partially functioning exhibits found by evaluators. The importance of functionality is also evident on comment cards. It follows that non-functional exhibits need to be the top priority for maintenance.

Issue # 2: Visitors report maintenance issues that make an exhibit partially functional at low levels

Depending on the data collection instrument, visitors also called some partially functioning exhibits broken. Most visitors who participated in the exit interviews did not report partially functional exhibits broken. However, on the surveys and during focus groups, participants identified exhibits with malfunctioning audio, sticky buttons, and computer bugs as broken, even though they were otherwise functional.

Partially functional exhibits may not be found unless visitors spend a prolonged time with an exhibit. In particular, slow or sticky buttons, audio issues, and computer bugs are a problem because bad interfaces affect the way a visitor interacts with exhibits, inviting "visitors to bang on your touchscreens, to try to wrench your joysticks out of the countertop" or hammer on your buttons and exhibits until they are broken (Oker, 1992, p. 167).

Issue # 3: Visitors sometimes call exhibits broken because of the way they are designed

Besides finding problems that affected an exhibit's functionality, many visitors said that a design issue made an exhibit broken. This "broken" design was seen across data collection instruments. Design issues that caused visitors to call exhibits broken included incorrect or missing information on labels, difficult to use or understand activities, and exhibits that appeared non-functional in their resting state.

On comment cards, one of the main "maintenance" complaints was that information found on labels was incorrect. One visitor, who complained that information presented on a nuclear energy exhibit was inaccurate, summarizes visitor issues with label copy on his comment card:

> At my recent visit I was surprised to see a statement about the safety of nuclear reactors in your "new exhibits" area. This statement said something to the effect that if the cooling system in a reactor malfunctioned, a "meltdown" could occur. While it is true in a "graphite" moderated reactor (as in the Chernobyl reactor), these reactors are not the design used in U.S. or any other western reactor, and I believe are no longer being built anywhere. In a modern, heavy-water moderated reactor, the coolant medium and the moderator are the same. If the reactor begins to overheat, the coolant boils off (possibly with some steam escape) and the reaction shuts down. . . If you could clarify the statement and identify its source, that would be great.

Though not very many visitors discover this type of problem, it will be disruptive to others. For this reason, it is important to check the accuracy of label copy before it reaches the exhibit floor and continue to check labels as technology changes.

Design issues were reported by some visitors on exit interviews and visitor surveys and made up many of the "broken" comments on comment cards and focus groups. Therefore, design is impacting the visitor experience. Although museums may not consider that the

design of exhibits can make an exhibit appear "broken," they need to think about the issue from the visitor's perspective. If the visitor cannot get an exhibit to work or feels that the content of an exhibit is incorrect, then they may view an exhibit as broken. By paying attention to the design of exhibits, the visitors' "sensory assessment" of exhibits will be positive, and visitors will have a better experience (Pine & Gilmore, 2005).

CONCLUSION

The results of the study illustrate that the number of broken exhibits that a visitor perceives they have found will negatively impact their experiences at a museum. In addition, encountering a lot of broken exhibits can cause visitors to feel disappointed and unhappy with their experiences. Visitors have demonstrated that some maintenance issues bother them more than others. This finding has implications for museum maintenance practices. It means that museums can create a list of priorities in their maintenance of exhibits and give varying levels of attention to different issues based on visitor concerns. The result is that a museum can focus on controlling the problems that most bother visitors.

The most pressing concern for visitors was functionality. Therefore, the top priority of any maintenance department should be making sure that as many exhibits as possible have some functionality. Exhibits that are chronically broken or non-functional can also be removed from the exhibit floor—a solution that was suggested by Wageman (2001a) during her "Everything is Broken" talk. The next highest priority for visitors was design. This demonstrates the importance of usability testing of exhibits during their prototyping stage. If it is discovered that exhibits have design issues after they make it onto the floor, these problems should be remediated or the exhibits should be removed. Last in importance for visitors were exhibits that had partial function.

The data suggest that if maintenance is addressed in the order of visitor concern, visitors may discover fewer negative cues within the galleries, thus improving their overall experiences. However, although broken exhibits are a component in determining the experience of visitors within the exhibit halls, they are not a silver bullet that determines the entire outcome of the visitor experience. Therefore, more studies that look at these factors through the visitor perspective should be performed to discover other ways to improve museum experience outcomes.

REFERENCES

Gutwill, J. (2001, July 5). *Do visitors find Exploratorium exhibits difficult to use? A report on an interview study* (Exploratorium Visitor Research and Evaluation Report). Retrieved October 17, 2005, from http://www.exploratorium.edu/partner/pdf/Challenging_exhs_ivwb_01.pdf.

Gutwill, J. (n.d.). *"Not working" sign study* (Exploratorium Visitor Research and Evaluation Report). Retrieved October 17, 2005, from http://www.exploratorium.edu/partner/pdf/Not_Working_ivwb_01.pdf.

McLean, K. (1993). *Planning for people in museums*. Washington, DC: Association of Science-Technology Centers.

Oker, J. (1992). Reliability of computer interactives or, why doesn't this @#!!& thing work? *The Sourcebook 1992*, 161–171.

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage Publications.

Pine, B. J., II, & Gilmore, J. H. (1999a). The experience economy. *Museum News, 78*(2), 45–48.

Pine, B. J., II, & Gilmore, J. H. (1999b). *The experience economy: Work is theater & every business a stage*. Boston: Harvard Business School Press.

Pine, B.J., II, & Gilmore, J. H. (2005). *Pine & Gilmore's field guide for the experience economy*. Aurora, OH: Strategic Horizons.

Randi Korn & Associates, Inc. (2000). *Summative evaluation: Executive summaries, discussion, and recommendations prepared for The Tech Museum of Innovation*. Available from the Randi Korn & Associates website, http://www.randikorn.com/dwdocs/Summaries.html.

Reich, C. A. (2005, May). *Universal design of interactives for museum exhibitions*. Unpublished master's thesis, Lesley University, Cambridge, MA.

Wageman, S. B. F. (2001a). *Everything is broken: Visitor perceptions and reality—paper*. Poster session presented at 2001 American Association of Museums Annual Meeting, St. Louis, MO. Available from The Tech Museum of Innovation website, http://www.thetech.org/rmp02/commentary_/everythingisbro_/aam2001everythi/office2k/office2k.htm.

Wageman, S. B. F. (2001b). *Everything is broken: Visitor perceptions and reality—slides*. Poster session presented at 2001 American Association of Museums Annual Meeting, St. Louis, MO. Available from The Tech Museum of Innovation website, http://www.thetech.org/rmp02/commentary_/everythingisbro_/aam2001everythi-1/office2k/office2k.htm.

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APPENDIX A: EXIT INTERVIEW

Explanation for participants about this study:

- The Museum is looking for feedback from our visitors about the design of our exhibits to help us to create better exhibits in the future.
- The length of this interview is approximately 5 to 7 minutes.
- Only one person in the group can participate (and that is you).
- We are looking for information about the gallery you just visited. I can point out the boundaries of the exhibition if you want.
- After you fill out the questionnaire, I have a few more questions to ask you.
- Your participation is voluntary and you can opt out of the interview at any time and we will throw out your survey.

Date: **Time of Day:** **Survey #:** **Interviewer Initials:**

Exhibit: _____ ***Making Models*** _____ ***Natural Mysteries***
_____ ***Messages*** _____ ***Seeing the Unseen***
_____ ***Investigate!***

1. About you. . .
Gender: _____ Male _____ Female **Age:** _____
Group Type: _____ Adults only _____ Kids only _____ Adults and kids
2. How many of the exhibits you visited in this gallery were broken or not working?
   0 1 2 3 4 5 6 7 8 9 10+
3. Please rate the following statement:
   "I was disappointed in the number of broken exhibits in this gallery."
   1 2 3 4 5 6 7 8 9 10
   Strongly disagree Strongly agree
4. Would you mind describing for me some examples of activities you tried to use in this gallery that were not working?
   a. How did you determine that this activity was not working?
   b. Do you have any other examples? (Ask this question until they name at least three activities or say they do not have any further activities they encountered)
      Example 1:
      Example 2:
      Example 3:
      Others:
5. Is there anything else you would like to add?

Thank you for your time. Enjoy your day at the Museum.

APPENDIX B: FOCUS GROUP QUESTIONS

1. What broken exhibits did you find in the galleries?
   - Did you notice anything wrong with the computers? Which ones?
   - Hands-on interactives? Which ones?
   - Signs or labels? Which ones?
   - Missing pieces? What was missing?
   - Audio hearphones or buttons? Which ones?
   - Anything else?
2. What did you do to determine that an exhibit was broken or not working?
   - Did you look at the exhibit?
   - Did you play/interact with the exhibit?
   - Did you watch other people using the exhibit?
   - What else did you do?
3. What criteria did you use to classify something as broken?
   - What were some common things that were broken on exhibits?
   - How did you go about figuring out if something is broken?
   - What cues let you know that something was not working?
4. How important is it for you that most of the exhibits in the gallery are working?
   - Is it more important that the gallery is fun?
   - Educational?
   - Easy to use?
   - Anything else?
   - What can the museum do to make exhibits better for the visitor?