



**Museum Visitor Studies, Evaluation & Audience Research**

Randi Korn & Associates, Inc.  
118 East Del Ray Avenue  
Alexandria, VA 22301

# **Exhibition Evaluation**

## **Summative Evaluation of *Green by Design* and *View from Space***

*Prepared for*  
**The Tech Museum of Innovation  
San Jose, CA**

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# EXECUTIVE SUMMARY

This report presents the findings from a summative evaluation of the *Green by Design* and *View from Space* exhibitions conducted by Randi Korn & Associates, Inc. (RK&A), for The Tech Museum of Innovation in San Jose, California. The evaluation documents the exhibitions' impact and effectiveness using timing and tracking observations, onsite exit interviews, and telephone interviews.

**Selected highlights of the study are included in this summary.  
Please consult the body of the report for a detailed account of the findings.**

## PRINCIPAL FINDINGS: TIMING AND TRACKING OBSERVATIONS

Data were collected at The Tech Museum in December 2007. The evaluators observed a total of 100 drop-in visitors 9 years of age and older.

### OVERALL VISITATION PATTERNS

- ◆ Visitors' total time in the exhibitions ranged from 6 seconds to 30 minutes, with a median time of about 4 minutes.
- ◆ Visitors stopped at between 1 and 18 exhibits, with a median of 3 exhibits.

### VISITATION TO *VIEW FROM SPACE*

- ◆ Of the 100 visitors observed, 45 percent visited *View from Space*.
- ◆ Visitors spent a median time of about 1 minute and stopped at a median of 1 exhibit in *View from Space*.

### VISITATION TO *GREEN BY DESIGN*

- ◆ Of the 100 visitors observed, 91 percent visited *Green by Design*.
- ◆ Visitors spent a median time of about 4 minutes and stopped at a median of 3 exhibits in *Green by Design*.
- ◆ Of the four subsections, visitors spent the most time in Harnessing Energy, followed by the Garage.
- ◆ More than one-half of visitors stopped in the Carport, Garage, and Harnessing Energy subsections.
- ◆ Few visitors stopped in The Tech Museum Awards, and those who did spent little time.

### VISITATION TO INDIVIDUAL EXHIBITS

- ◆ Visitors spent the most time at MPG Marathon computer interactive.
- ◆ Visitors spent the least time at the SELCO Solar Light panel and artifact and Annual Award Celebrates Technology that Benefits Humanity panel.
- ◆ The *View from Space* theater attracted the most visitors, followed by the Solar Station interactive, Water Station interactive, Innovation and Technology Fuel the Future introduction panel, and the Supercapacitor interactive.
- ◆ The Hermannsburg, Australia Solar Dish graphic panel; Harnessing Energy panel; and Tubular Skylight/Make the Switch to Energy Efficient Lighting three-sided panel attracted the fewest visitors.

## VISITOR BEHAVIORS

- ◆ 8 percent turned the three-sided panels.
- ◆ 5 percent used the Tech Tags.
- ◆ 2 percent interacted with Museums staff.

## PRINCIPAL FINDINGS: ONSITE EXIT INTERVIEWS

RK&A conducted onsite interviews in January 2008 with visitors as they exited the *Green by Design* and *View from Space* exhibitions. The evaluators interviewed a total of 27 visitor groups.

### REACTIONS TO *GREEN BY DESIGN* AND *VIEW FROM SPACE*

Most interviewees expressed positive opinions about the exhibitions, in particular, the Harnessing Energy exhibits in *Green by Design* and the projection globe (Science on a Sphere) in *View from Space*. In contrast, several interviewees thought the exhibitions lacked information or adequate interpretation.

When asked which exhibits in the exhibitions they would consider “cutting-edge,” many interviewees selected the *View from Space* projection globe and some others chose the Supercapacitor interactive. A few said they did not consider any of the exhibits in the exhibitions to be cutting-edge.

### UNDERSTANDING OF EXHIBITION CONTENT

About three-quarters of interviewees had visited exhibits in both *Green by Design* and *View from Space*. Of those, most cited energy conservation as the general connection between the two exhibitions. A few said the exhibitions showed problems (global climate change) and solutions (alternative energy or the reduction of carbon emissions).

About one-half of interviewees stopped at The Tech Museum Awards. Of those, most thought the awards celebrate “innovation” and “human ingenuity,” in general.

### RESPONSE TO ENVIRONMENTAL MESSAGES

When asked what they had learned about technology, environmental conservation, and green design from visiting the exhibitions, most interviewees said that they did not learn any new information that they had not been previously exposed to either in school or through the media. However, some gained a greater understanding of specific topics (e.g., the energy efficiency of compact florescent light bulbs and LED lights, solar panels, regenerative braking, alternative types of insulation).

Most interviews said the exhibitions’ presentation of environmental issues was balanced, while a few thought there should be more information comparing green approaches with conventional technologies.

Interviewees expressed an interest in learning more about several environmental topics, including cost and energy comparisons among different technologies (e.g., solar panels); production, use, and disposal lifecycle of green technologies; and recycling and waste management.

## PRINCIPAL FINDINGS: TELEPHONE INTERVIEWS

RK&A conducted telephone interviews with adults who had visited *Green by Design* and/or *View from Space* in winter and spring 2008. A total of 129 telephone numbers were collected from visitors as they

exited the exhibitions, from which a random sample of 50 visitors was selected for the telephone interviews. Interviews were conducted approximately two to three weeks after an interviewee's visit.

### **RESPONSE TO GREEN BY DESIGN AND VIEW FROM SPACE**

After interviewees were reminded of the exhibitions' location and general layout, they were asked what they recalled from their visit. Nearly two-thirds of interviewees remembered the Harnessing Energy exhibits in *Green by Design*, and over one-half mentioned the *View from Space* projection globe.

One-quarter of interviewees said they used the *View from Space* kiosk. Of those, most recalled viewing information about specific topics (e.g., wind patterns, hurricanes, water currents) and enjoying the opportunity to manipulate the globe's display. In contrast, a couple of interviewees had tried to use the kiosk but could not load it properly, one was unsure of the relationship between the kiosk and the globe, and another was overwhelmed by the amount of content provided in the kiosk.

One-third of interviewees said they attended the Global Climate Change live presentation. Most praised the presentation's content and displays on the projection globe, while a few could not recall anything specific about the presentation.

### **UNDERSTANDING OF EXHIBITION CONTENT**

The evaluator asked interviewees what ideas or messages they gleaned from their experiences in the exhibitions and the Global Climate Change presentation, if they attended it. Most interviewees discussed specific information learned from *Green by Design* exhibits, *View from Space* exhibits, or the Global Climate Change presentation, rather than a holistic sense of these elements combined—even though many had used multiple offerings. Several interviewees said they did not learn anything, having spent little time in the exhibitions or having had difficulty understanding the presentation.

### **RESPONSE TO ENVIRONMENTAL MESSAGES**

When asked what they had learned about global climate change, technology, and environmental conservation from the exhibitions and presentation, about three-quarters of interviewees were able to describe an environmental message to varying degrees. Some discussed issues related to energy conservation or alternative energy sources, some others mentioned global warming, and a few combined those two ideas. One-quarter of interviewees had no recollection of the environmental content.

### **OPINION ABOUT PRESENTATION OF ENVIRONMENTAL MESSAGES**

Interviewees who perceived an environmental message in the exhibitions and/or presentation were asked their opinion of The Tech Museum addressing such issues. Nearly all interviewees were in favor of the Museum addressing environmental topics; however, a couple of interviewees either were not interested in the subject matter or said addressing these topics was not the Museum's responsibility.

### **ACTIONS TAKEN AFTER THEIR VISIT**

Interviewees who sensed an environmental message in the exhibitions and/or presentation were also asked whether they had taken any actions to address environmental issues following their visit. Most interviewees said they had not done anything new that they were not doing prior to their visit. However, several interviewees credited their visit with heightening their awareness of environmental issues, reinforcing existing pro-conservation behavior, or generating thoughts related to choosing green options.

## DISCUSSION AND RECOMMENDATIONS

*Green by Design* and *View from Space* provided visitors with engaging experiences. Visitors found particularly compelling the Science on a Sphere projection globe in *View from Space* and the interactive exhibits in *Green by Design* that enabled them to examine differences between technologies or build their own creations. *Green by Design* and *View from Space* were most successful in conveying their intended messages and demonstrating their complimentary content when visitors both used the exhibits and attended a Global Climate Change program. Additionally, the exhibitions most resonated with visitors who had prior knowledge and interest in environmental issues: they were the ones who tended to see connections between the two exhibitions and discuss how the exhibitions relate to their daily lives.

For visitors who were not already environmentally conscious, the exhibitions were enjoyable but not necessarily meaningful. These visitors needed additional information and experiences to widen their knowledge base and begin developing a concern for global climate change and green design—before they would be ready to implement environmentally-friendly practices in their daily lives. RK&A found in another study that even very focused messaging and programming were unable to motivate many visitors to change their seafood purchasing habits as other factors—taste preference and price—took precedence over environmental concerns\*. Changing people’s behavior is a difficult challenge for schools and other regimented programs—much less informal learning environments. That said, most Tech Museum visitors applauded the Museum’s efforts to discuss environmental issues and welcomed such information. Future exhibitions at the Museum can build on the successes and learn from the shortcomings of *Green by Design* and *View from Space*. In that vein, recommendations are provided below.

### RECOMMENDATIONS

- ◆ Consider developing a presentation for the kiosk that would deliver similar content as the Global Climate Change program for the times between live programming. Additionally, draw attention to the *View from Space* kiosk so that more visitors are aware that they can use it to control the display on the globe when live programs are not taking place. For example, add text to the presentation schedule sign that states, “No Program? Use the Kiosk ➔ to Control the Globe,” and modify the kiosk’s attract screen graphics to state the purpose of the kiosk (e.g., “Control the Globe Here”).
- ◆ To help additional visitors perceive and experience *View from Space* and *Green by Design* as related exhibitions, consider revising the layout to include a more defined introductory area where the conceptual framework of the exhibitions—environmental challenges (climate change and carbon emissions) and solutions (alternative green technology) can be explicitly interpreted.
- ◆ Provide visitors information and opportunities to weigh different environmental choices. For example, the Light Bulb and Bright Ideas interactives were often praised for letting visitors see for themselves the energy savings of various technologies.

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\* Randi Korn & Associates, Inc. (2003). *Vanishing Wildlife* Summative Evaluation. Unpublished manuscript. Monterey, CA: Monterey Bay Aquarium.

- ◆ Leverage the success of the Harnessing Energy exhibits in *Green by Design* when designing new experiences at the Museum. Visitors responded well to the interactive and open-ended approach to those exhibits, and the design challenge model is at the core of the Museum’s mission and pedagogy.
- ◆ To respond to the needs of visitors with a range of knowledge about environmental topics, explore ways to layer the information delivery. Reconsider the three-sided, free-standing graphic panels used in *Green by Design* in favor of a graphic design system that allows specific content to be presented on or close to the exhibit elements.
- ◆ Visitors expressed an interest in The Tech Museum featuring exhibits about sustainable, “green” technology. Beyond the lifecycle of the *View from Space* and *Green by Design* exhibitions, consider dedicating gallery space to addressing current topics related to technology and the environment.
- ◆ Visitors to the Museum expect to see and use technology not readily available at the consumer level. However, the standard museum exhibit development process is lengthy and does not often keep in step with the rapid evolution of high technology. Consider developing several small exhibits, which could be produced in months rather than years in order to ensure that the technology highlighted in the exhibition truly is “cutting- edge” and novel for most visitors.



# INTRODUCTION

This report presents the findings from a summative evaluation of the *Green by Design* (GBD) and *View from Space* (VFS) exhibitions conducted by Randi Korn & Associates, Inc. (RK&A), for The Tech Museum of Innovation in San Jose, California. GBD was funded by the Moore Foundation and VFS was funded by the National Oceanic and Atmospheric Administration (NOAA). The two exhibitions were evaluated together for logistical reasons—the exhibitions are adjacent to each other and visitors readily flow between the two spaces—and content reasons—the information and messages of the two exhibitions were intended to complement each other.

Data were collected from December 2007 to April 2008. The evaluation documents the exhibitions' impact and effectiveness by examining visitors':

- ◆ Use of GBD and VFS (at which exhibits they stop, which they bypass, how much time they spend at individual exhibits, how much time they spend in the exhibition as a whole, and select behaviors),
- ◆ Quality of their visit to GBD and VFS,
- ◆ Perceptions of the exhibits as being “cutting edge,”
- ◆ Understanding of The Tech Museum Awards,
- ◆ Understanding of the connection between GBD and VFS,
- ◆ Opinions about and understanding of the environmental messages in the GBD and VFS exhibitions and VFS program,
- ◆ Desire to see additional environmental topics addressed in The Tech, and
- ◆ Actions taken to address the environmental issues presented (e.g., use compact fluorescent light bulbs).

## METHODOLOGY

RK&A used three data collection strategies to assess visitors' experiences in the exhibition: timing and tracking observations, onsite exit interviews, and telephone interviews.

### TIMING AND TRACKING OBSERVATIONS

Visitor observations provide an objective and quantitative account of how visitors behave and react to exhibition components. Observational data indicate how much time visitors spend within the exhibition and suggest the range of visitor behaviors.

All visitors 9 years of age and older were eligible to be unobtrusively observed in the exhibition. The data collector selected visitors to observe using a continuous random sampling method. In accordance with this method, the observer stationed him/herself in front of the GBD and VFS exhibitions, and observed the first eligible visitor to enter either one, following the selected visitor through the exhibitions, recording the exhibits used, noting select behaviors, and logging total time spent in the exhibitions (see Appendix A for the observation form). When the visitor completed his or her visit, the observer returned to the entrance to await the next eligible visitor to enter either exhibition.

In addition to recording stops made and time spent at each exhibit, the data collector also noted specific behaviors listed on the observation form including misusing an exhibit (using an exhibit in ways developers did not intend).

## INTERVIEWS

Open-ended interviews produce data rich in information because interviewees are encouraged and motivated to describe their experiences, express their opinions and feelings, and share with the interviewer the meaning they constructed during a visit. The interview guides were intentionally open-ended to allow interviewees to discuss what they felt was meaningful. All interviews were audio-recorded with participants' permission and transcribed to facilitate analysis.

### ONSITE EXIT INTERVIEWS

Upon exiting the exhibition, visitors 12 years and older were eligible to be selected for participation following a continuous random sampling method, as described above. Eligible visitors were invited to answer several questions about their exhibition experiences immediately following their visit (see Appendix B for the onsite exit interview guide).

### TELEPHONE INTERVIEWS

Post-visit telephone interviews were conducted with visitors two to four weeks after their visit to determine longer-term effects of their visit to *GBD* and *VFS*. Telephone numbers were collected by systematically intercepting visitors as they exited *VFS*. Visitors were not told that they would be interviewed about *GBD* or *VFS* to avoid cueing them to remember their experiences in the exhibitions and biasing the data.

Only visitors 18 years of age and older were approached for a telephone interview. RK&A selected a random sample of interviewees from the telephone numbers collected. Visitors were asked to recall their experiences in *GBD* and *VFS* as well as discuss how they may have acted upon what they learned in these exhibitions (see Appendix C for the telephone interview guide).

## DATA ANALYSIS

### QUANTITATIVE ANALYSIS

The observation data were analyzed using SPSS 12.0.1, a statistical package for personal computers. Analyses include both descriptive and inferential statistics. Within the body of the report, only statistically significant relationships are presented; however, all statistical analyses that were run with the observation data are listed in Appendix D.<sup>2</sup>

Frequency distributions were calculated for all categorical variables (such as “age,” or whether or not a visitor “used the Tech Tag”). To examine the relationship between two categorical variables (for instance, “visiting with a child” and “used the Tech Tag”), cross-tabulation tables were computed to show the joint frequency distribution of the variables, and the chi-square statistic ( $X^2$ ) was used to test the significance of the relationship.

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<sup>2</sup> The level of significance was set at 0.01 because of the moderate sample size. When the level of significance is set to  $p = 0.01$ , any relationship that exists at a probability ( $p$ -value) of  $\leq 0.01$  is termed “significant.” When a relationship has a  $p$ -value of 0.01, there is a 99 percent probability that the relationship being explored truly exists; that is, in 99 out of 100 cases, there would be a relationship between the two variables (e.g., age and exhibits stopped at). Conversely, there is a 1 percent probability that the relationship does not really exist; in other words, in 1 out of 100 cases, a relationship would appear by chance.

Summary statistics, including the mean (average), median (data point at which half the responses fall above and half fall below), and standard deviation (spread of scores: “±” in tables), were calculated for ratio-level variables (such as, “total time spent in the exhibition”)<sup>3</sup>. To test differences in the medians of two or more groups, a Mann-Whitney U test was performed (for instance, to examine whether the “total time in the exhibition” differed by “age” or “gender”).

## QUALITATIVE ANALYSIS

The interview data are qualitative, meaning that results are descriptive, following from the interviews’ conversational nature. In analyzing the data, the evaluator studied responses for meaningful patterns, and, as patterns emerged, grouped similar responses. To illustrate interviewees’ ideas as fully as possible, verbatim quotations (edited for clarity) are included.

## REPORTING METHOD

The data in this report are quantitative and qualitative. For the quantitative data, information is displayed in tables and graphs. Percentages within tables may not always equal 100 owing to rounding. The findings within each topic are presented in descending order, starting with the most-frequently occurring.

The interview data are presented in narrative. The interviewer’s remarks appear in parentheses, and, for visitors, an asterisk (\*) signifies the start of a different speaker’s comments. At the end of each quotation, the interviewee’s status (adult or child), age, and where s/he was interviewed is indicated in brackets. Trends and themes in the data are presented from most- to least-frequently occurring.

### FINDINGS IN THIS REPORT ARE PRESENTED IN THREE MAIN SECTIONS:

1. Timing and Tracking Observations
2. Onsite Exit Interviews
3. Telephone Interviews

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<sup>3</sup> For the most part, medians rather than means are reported in this document because, as is typical, the number of components used and the time spent by visitors were distributed unevenly across the range. For example, whereas most visitors spent a relatively brief time with exhibition components, a few spent an unusually long time. When the distribution of scores is extremely asymmetrical (i.e., “lopsided”), the mean is strongly affected by the extreme scores and, consequently, falls further away from the distribution’s central area. In such cases, the median is the preferred measurement because it is not sensitive to the values of scores above and below it—only to the number of such scores.

## PRINCIPAL FINDINGS: TIMING & TRACKING OBSERVATIONS

Observers timed and tracked visitors in *Green by Design (GBD)* and *View from Space (VFS)* in December 2007. Data collectors observed a total of 100 drop-in visitors 9 years of age and older.

### DATA COLLECTION CONDITIONS

Three-quarters of the observations took place on weekend days (73 percent) and one-quarter on weekdays (27 percent) (see Table 1). Three-quarters of the observations were collected in the afternoon (73 percent) and one-quarter in the morning (27 percent). Nearly two-thirds of visitors experienced a moderate level of crowding (61 percent). Overall, few visitors experienced broken exhibits (8 percent).

**TABLE 1**  
**DATA COLLECTION CONDITIONS**

<b>CONDITIONS (n = 100)</b>	<b>%</b>
<b>Day of the Week</b>	
Weekend day	73.0
Weekday	27.0
<b>Time of Day</b>	
PM	73.0
AM	27.0
<b>Level of Crowding</b>	
Moderate	61.0
High	21.0
Low	18.0
<b>Broken Exhibits</b>	
No broken exhibits	92.0
1 or 2 broken exhibits*	8.0

\*Observers noted that the following exhibits were broken during the data collection period: Bright Ideas interactive, five times; Supercapacitor interactive, three times; and Light Bulb interactive, one time.

## VISITOR DESCRIPTIONS

Data collectors recorded the gender and approximate age of each observed visitor. As shown in Table 2, the sample included slightly more females than males (58 percent and 42 percent, respectively). More than one-half of visitors observed were adults (18 years and older) and less than one-half were children (between 9 and 17 years) (57 percent and 43 percent, respectively).

**TABLE 2**

### VISITOR DEMOGRAPHICS

CHARACTERISTIC ( <i>n</i> = 100)	%
<b>GENDER</b>	
Female	58.0
Male	42.0
<b>APPROXIMATE AGE GROUP</b>	
9 to 11 years	20.0
12 to 14	12.0
15 to 17	11.0
18 to 24	13.0
25 to 34	12.0
35 to 44	24.0
45 to 54	5.0
55 to 64	2.0
65 years and older	1.0

About one-half of observed visitors attended the exhibition in a multigenerational group (49 percent); whereas one-quarter were visiting in adult-only groups (26 percent) (see Table 3).

**TABLE 3**

### GROUP COMPOSITION

DESCRIPTION ( <i>n</i> = 100)	TOTAL %
Adults and children group	49.0
Adults only group	26.0
Alone	11.0
Children only group	14.0

## OVERALL VISITATION PATTERNS

This section presents the total time spent and stops made in *VFS* and *GBD* combined, because of the proximity of the exhibitions and their intended conceptual connection.

### TOTAL TIME SPENT IN THE EXHIBITIONS

Visitors' total time in *VFS* and *GBD* ranged from 6 seconds to 30 minutes, with a median time of 3 minutes and 36 seconds (see Table 4). Twenty-seven percent of visitors spent less than 2 minutes in the exhibition, 25 percent spent between 2 and 4 minutes, 20 percent spent between 4 and 6 minutes, and 28 percent spent 6 minutes or longer in the exhibition.

**TABLE 4**  
**TOTAL TIME SPENT IN THE EXHIBITIONS**

<b>TOTAL TIME (<i>n</i> = 100)</b>	<b>%</b>
Less than 2 minutes	27.0
2 min. – 4 min.	25.0
4 min. – 6 min.	20.0
Longer than 6 min.	28.0
<b>SUMMARY STATISTICS (<i>n</i> = 100)</b>	<b>MIN:SEC</b>
Range	0:06 to 29:28
Median time	3:36
Mean time	5:23
(±) Standard deviation	± 5:47

## TOTAL NUMBER OF EXHIBITS AT WHICH VISITORS STOPPED

*VFS* and *GBD* included 25 exhibits at which visitors could stop. For this evaluation, a “stop” was defined as a visitor standing for three seconds or longer in front of a component. If a visitor returned to a component at which s/he had previously stopped, this return was not counted as an additional stop, but the amount of time spent was included in the total time spent at the component.

Visitors stopped at between 1 and 18 exhibits, with a median of 3 exhibits (see Table 5). Thirty-eight percent of visitors stopped at 1 to 2 exhibits, 26 percent stopped at 3 to 4 exhibits, 22 percent stopped at 5 to 6 exhibits (22 percent), and 14 percent stopped at 7 or more exhibits.

**TABLE 5**

**TOTAL NUMBER OF EXHIBITS STOPPED AT IN THE EXHIBITIONS**

<b>NUMBER OF EXHIBITS (<i>n</i> = 100)</b>	<b>%</b>
1 to 2 exhibits	38.0
3 to 4	26.0
5 to 6	22.0
7 or more	14.0
<b>SUMMARY STATISTICS (<i>n</i> = 100)</b>	
Range	1 to 18 exhibits
Median number	3 exhibits
Mean number	4 exhibits
(±) Standard deviation	3 exhibits

## VISITATION TO VIEW FROM SPACE

This section presents the time spent and stops made in *VFS*. Of the 100 visitors observed, 45 percent visited *VFS*. Visitors spent a median time of about 1 minute in *VFS* (see Table 6). Of the two exhibits featured in *VFS*, visitors stopped at a median of 1 exhibit.

**TABLE 6**  
**VISITATION TO VIEW FROM SPACE**

<b>TIME: SUMMARY STATISTICS (n = 45)</b>	<b>MIN:SEC</b>
Range	0:07 to 28:35
Median time	1:09
Mean time	2:17
(±) Standard deviation	± 4:30
<b>STOPS MADE: SUMMARY STATISTICS (n = 45)</b>	<b>NUMBER</b>
Range	1 to 2 exhibits
Median number	1 exhibit
Mean number	1 exhibit
(±) Standard deviation	>1 exhibit

## VISITATION TO GREEN BY DESIGN

This section presents the time spent and stops made in *GBD*. Of the 100 visitors observed, 91 percent visited *GBD*. Visitors spent a median time of 3 minutes, 34 seconds in *GBD* (see Table 7). Of the 23 exhibits featured in *GBD*, visitors stopped at a median of 3 exhibits.

**TABLE 7**  
**VISITATION TO GREEN BY DESIGN**

<b>TIME: SUMMARY STATISTICS (n = 45)</b>	<b>MIN:SEC</b>
Range	0:06 to 23:30
Median time	3:34
Mean time	4:47
(±) Standard deviation	± 4:48
<b>STOPS MADE: SUMMARY STATISTICS (n = 45)</b>	<b>NUMBER</b>
Range	1 to 17 exhibits
Median number	3 exhibits
Mean number	4 exhibits
(±) Standard deviation	3 exhibits



*GBD* included four main subsections: the Garage, Harnessing Energy, The Tech Museum Awards, and the Carport. Visitors spent the most time in Harnessing Energy (median = 1 minute, 47 seconds), followed by the Garage (median = 1 minute, 17 seconds) (see Table 8). About one-half of visitors stopped in the Carport, Garage, and Harnessing Energy (51 percent, 47 percent, and 47 percent, respectively).

Few visitors stopped in The Tech Museum Awards (8 percent), and those who did spent little time (median = 18 seconds).

**TABLE 8**  
**VISITATION TO *GBD* SUBSECTIONS**

<b>SUBSECTIONS (<i>n</i> = 100)</b>	<b>% OF VISITORS WHO STOPPED</b>	<b>MEDIAN TIME MIN:SEC</b>
Harnessing Energy	47.0	1:47
Garage	47.0	1:17
Carport	51.0	0:55
The Tech Museum Awards	8.0	0:18

## VISITATION TO INDIVIDUAL EXHIBITS

### TIME SPENT AT EACH EXHIBIT

Visitors spent the most time at MPG Marathon computer interactive (median = 1 minute, 25 seconds), followed by the Harnessing Energy panel (median = 1 minute, 7 seconds) (see Table 9). Visitors spent the least time at the SELCO Solar Light panel and artifact and Annual Award Celebrates Technology that Benefits Humanity panel (each median = 5.5 seconds). No visitors stopped at the Tubular Skylight/Make the Switch to Energy Efficient Lighting three-sided panel.

**TABLE 9**

**TIME SPENT AT INDIVIDUAL EXHIBITS**

EXHIBIT COMPONENT ( <i>n</i> = 100)	NUMBER OF VISITORS WHO STOPPED	MEDIAN TIME (SEC.)
MPG Marathon computer interactive	18	85.0
Harnessing Energy panel	1	67.0
<i>View from Space</i> theater	42	58.5
<i>View from Space</i> kiosk	7	58.0
Supercapacitor interactive	33	58.0
Light Bulb interactive	17	51.0
Wind Station interactive	28	46.0
Water Station interactive	35	45.0
Solar Station interactive	39	42.0
Regenerative Braking interactive	26	31.0
Bright Ideas interactive	14	25.5
Electric Vehicle artifact and panel	37	25.0
Protovoltaic Cell/New Technologies Focus on Affordable Solar Panels three-sided panel	17	22.0
Save Energy at Home kiosk	7	21.0
KickStart panel and artifact	5	20.0
ABT Insulpanel/"Green" Insulation is a Natural Choice three-sided panel	6	16.0
Innovation and Technology Fuel the Future panel	34	15.5
Electric Motocross artifact	6	14.5
Hermannsburg, Australia Solar Dish graphic panel	2	13.5
Freeplay Foundation panel and artifact	4	9.5
Brunsbüttel Germany Wind Turbine graphic panel	3	8.0
Itaipu Brazil Dam graphic panel	3	7.0
SELCO Solar Light panel and artifact	6	5.5
Annual Award Celebrates Technology that Benefits Humanity panel	4	5.5
Tubular Skylight/Make the Switch to Energy Efficient Lighting three-sided panel	0	0.0

**STOPS MADE AT EACH EXHIBIT**

Visitors could stop at 25 exhibits in *VFS* and *GBD* combined (see Table 10). The exhibit at which the most visitors stopped was the View from Space theater (42 percent), followed by the Solar Station interactive (39 percent), Water Station interactive (35 percent), Innovation and Technology Fuel the Future introduction panel (34 percent), and the Supercapacitor interactive (33 percent). The fewest visitors stopped at the Hermannsburg, Australia Solar Dish graphic panel (2 percent) and the Harnessing Energy panel (1 percent). As noted earlier, no visitors stopped at the Tubular Skylight/Make the Switch to Energy Efficient Lighting three-sided panel.

**TABLE 10**  
**INDIVIDUAL EXHIBITS AT WHICH VISITORS STOPPED**

<b>EXHIBIT COMPONENT (n = 100)</b>	<b>% VISITORS WHO STOPPED</b>
<i>View from Space</i> theater	42.0
Solar Station interactive	39.0
Water Station interactive	35.0
Innovation and Technology Fuel the Future introduction panel	34.0
Supercapacitor interactive	33.0
Wind Station interactive	28.0
Light Bulb interactive	17.0
Protovoltaic Cell/New Technologies Focus on Affordable Solar Panels three-sided panel	17.0
Bright Ideas interactive	14.0
<i>View from Space</i> kiosk	7.0
Save Energy at Home kiosk	7.0
ABT Insulpanel/“Green” Insulation is a Natural Choice three-sided panel	6.0
SELCO Solar Light panel and artifact	6.0
Electric Motocross artifact	6.0
KickStart panel and artifact	5.0
Annual Award Celebrates Technology that Benefits Humanity panel	4.0
Freeplay Foundation panel and artifact	4.0
Itaipu Brazil Dam graphic panel	3.0
Brunsbüttel Germany Wind Turbine graphic panel	3.0
Hermannsburg, Australia Solar Dish graphic panel	2.0
Harnessing Energy panel	1.0
Tubular Skylight/Make the Switch to Energy Efficient Lighting three-sided panel	0.0

## VISITOR BEHAVIORS

Observers noted a number of visitor behaviors depending on the exhibit. The total incidences of three are presented in Table 11. Detailed information about behaviors at individual exhibits is provided in Appendix E.

Few visitors turned the three-sided panels to access information on multiple sides, used the Tech Tags, or interacted with staff (8 percent, 5 percent, and 2 percent).

**TABLE 11**  
**PERCENTAGE OF VISITORS WHO EXHIBITED SPECIFIC BEHAVIORS**

<b>BEHAVIOR (<i>n</i> = 100)</b>	<b>%</b>
Turn three-sided panels (available at 3 exhibits)	8.0
Use Tech Tag (available at 3 exhibits)	5.0
Interact with staff (available at 3 exhibits)	2.0

## PRINCIPAL FINDINGS: ONSITE EXIT INTERVIEWS

RK&A conducted onsite interviews in January 2008 with visitors as they exited the *Green by Design* and *View from Space* exhibitions. The Tech Museum staff offered the *View from Space* Global Climate Change presentation at six scheduled times throughout the two days of data collection.

### VISITOR DEMOGRAPHICS

RK&A interviewed 27 visitor groups comprised of 49 individuals (including 39 adults and 10 children). Of the 61 visitors approached, 12 declined to participate; for a 5 percent refusal rate.

Overall, male interviewees (52 percent) outnumbered female interviewees (48 percent). The adults ranged in age from 19 to 62, with a median age of 42 years. The children ranged in age from 5 to 17, with a median age of 9 years.

Thirty-one (63 percent) of the 49 interviewees were visiting The Tech Museum for the first time and 18 (37 percent) had visited the Museum previously. Of the 18 interviewees who had visited the Museum within the past year, 12 had visited on one previous occasion, four had visited twice before, and two had visited on three other occasions. Three interviewees said they were current members of the Museum—two interviewees said they had been members since the Museum opened, and one said he joined the day of the interview. Two interviewees said they had been Museum members in the past but had not renewed their membership.

Over one-half (17) of the reported non-members cited not living in the San Jose area as the primary reason for not becoming members of The Tech Museum. Several said they would become members if they had school-age children. A few interviewees said they would be more likely to become members if they were exposed to more advertising or information about the Museum's offerings. A few others said they would be encouraged to join if The Tech offered combined memberships with other museums. A couple of interviewees said they would be more likely to become a member if the Museum's exhibits changed more frequently.

### REACTIONS TO *GREEN BY DESIGN* AND *VIEW FROM SPACE*

#### OVERALL OPINION OF THE EXHIBITIONS

When asked their overall opinion of *Green by Design* and *View from Space*, most interviewees responded favorably, using terms such as “good,” “interesting,” and “informative” when describing the exhibitions. Many interviewees praised the interactive aspects of *Green by Design*, especially the Harnessing Energy exhibits—the wind, solar, and water turbine design challenges (see the first quotation below). Some interviewees indicated that the exhibition content was clear and accessible (see the second quotation), and two interviewees noted the environmental and social relevance of the energy conservation topic (see the third quotation). A few interviewees commented that the exhibitions treated the topics in a superficial manner and did not provide enough information (see the fourth quotation).

(Overall, what's your opinion of the exhibition?) I thought it was engaging and hands-on. There were things for the kids to do that got them interested like the neat wind and water power stuff

in the back. It really got the kids involved in figuring out how to use renewable energy to make things more efficient. [female, 46]

I like it. (What do you like about the exhibition?) I think it [*Green by Design*] covers a good amount of what people call green technology and explains it in an easy enough way where you don't have to have a college degree to understand how it works. [male, 23]

I was glad to see this kind of information presented. It's timely. This [exhibition] wasn't here last time I was here. It's good to see the connection being made more strongly between technology and what's going on in the world in terms of the environment. [female, 47]

It [*Green by Design*] was okay, but it seemed a bit shallow. I think it needs a little more science behind what's going on, a little bit less hands-on and more information or more in-depth exhibits. [male, 19]

### **MOST AND LEAST INTERESTING ASPECTS OF THE EXHIBITION**

The evaluator asked interviewees which aspects of the exhibitions were most compelling. Interviewees cited two exhibits most frequently: the Harnessing Energy exhibits in *Green by Design* and the projection globe (Science on a Sphere) in the *View from Space* theater. As noted above, many interviewees favored the interactivity of the Harnessing Energy exhibits and said they enjoyed the opportunity to test and compare wind, solar, and water energy first-hand (see the first and second quotations below). Additionally, many interviewees were impressed with the 3-D nature of the projection globe (see the third and fourth quotations).

I like the wind and water one over there [points to back area of *Green by Design*]. (What makes you say that?) It gives people a hands-on idea of what principles are involved in producing power. It's a good design. It was really easy to swap out the blades and swing the angles a bit and stuff like that in order to optimize the power. It's a good way of showing that electricity doesn't just come from flipping a switch. [female, 34]

I liked the one [exhibit] where you had to build the things that spin around [turbines]. I was glad to see some good hands-on ways of learning about energy. It was great to be able to try things to see how they work. You could actually build things and make them work instead of just passively watching. [male, 47]

I liked the planet thing. (Are you referring to the big globe?) Yeah, it's really cool how it gives a visual representation of how the weather systems work and how they affect everything globally. [male, 26]

The big globe is incredible. It's great to be able to see the planet through different eyes—from a different perspective. Seeing things on a computer screen is one thing, but having the three-dimensionality just makes it more real. [female, 57]

Some interviewees said the electric cars were their favorite part of the exhibitions and noted the visual appeal and sustainability of the vehicles (see the first quotation below). A few interviewees appreciated the straightforward and practical information the Make the Switch to Energy Efficient Lighting exhibit presented (see the second quotation).

I liked the cars. (What makes you say that?) They're really cute. . . . \*Yeah, they're cool looking. I can't wait to be able to buy one. They're still slow, but it gives me hope that we'll soon be able to have truly green cars. [female, 20; male, 35]

Clear, visual examples like that light bulb comparison really drive home the point about energy savings. I liked its simplicity and its focus on energy efficiency is great. [male, 42]

When asked what their least favorite aspect of the exhibitions was, many interviewees said “nothing.” However, several interviewees commented that the exhibitions lacked information or adequate interpretation (see the first quotation below). Some interviewees cited the Garage area in *Green by Design* as their least favorite aspect of the exhibition and said it lacked interactivity (see the second quotation).

The printed information [exhibit labels] is extremely brief. You could have five times the amount of information in there for people who are interested in learning more about the different technologies. (What aspects would you like to know more about?) Well, the solar panels are one example. There are different types of cells displayed but, except for their names, there's no real information about them provided. It would be good to be able to compare the energy produced by the different types of panels. [male, 46]

(What aspect of the exhibition did you like the least?) Probably this front area [points to Garage] because my kids were kind of bored by this part where you just walk around and look. There's not a lot to do compared to that area in the back [Harnessing Energy interactive area]. Like, the fans on the wall [Bright Ideas exhibit] don't really do anything. What's the point? [female, 34]

## PERCEPTIONS OF CUTTING-EDGE EXHIBITS

The evaluator asked the interviewees what characteristics they would expect to see in “cutting-edge” exhibits. Most interviewees indicated they would expect to see the newest technology—either products that are not yet available commercially or applications of technology anticipated in the future (see the first quotation below). Some said they associate computer technology and 3-D visualizations as cutting-edge rather than physical or mechanical interactive exhibits (see the second quotation).

I'd like to see things I've never heard of—the latest and greatest technology that you can't buy at the store. [female, 49]

I would expect to see more computerized stuff like with video or 3-D animation. There's something kind of old fashioned about these things [exhibits] here [in *Green by Design*] where you either just push the button or play with physical stuff. I'm sort of nostalgic for the old stuff, but I wouldn't say it's cutting-edge. [male, 37]

When asked which exhibits in *Green by Design* and *View from Space* they considered “cutting-edge,” many interviewees pointed to the *View from Space* projection globe (see the first quotation below). Additionally, some interviewees described the Supercapacitor car race exhibit as cutting-edge because it features a new, not widely known technology (see the second quotation), and a few interviewees referred to the LED lights features in the Make the Switch to Energy Efficient Lighting exhibit as cutting-edge (see the third quotation). One interviewee said that although it is low-tech, the Tubular Skylight is cutting-edge because she had never seen it before. In contrast, a few interviewees said they did not consider any of the exhibits in *Green by Design* or *View from Space* to be cutting-edge (see the fourth quotation).

I'd say the display on the globe is pretty cutting-edge. (What makes you say that?) The display is very well done. The projection is 360. I think it's cool to be able to see the whole globe and walk around it. You surely couldn't do that in the old museums when I was a kid. [male, 56]

(Which exhibits in this area, in any, would you describe as cutting-edge?) I'd say the exhibit with the two cars racing because it shows a new kind of power source. It shows that in the very near future batteries won't even be something that people consider using anymore. [female, 47]

Cutting-edge? Well, the LED lights are pretty new. I don't think they're available for home lighting yet. Maybe that's the next wave after the curly light bulbs. [female, 25]

None of this stuff [exhibits] fits with my definition of cutting-edge. It's all existing technology that we already know about. I'd like to learn about new technologies that might still be in development. [male, 50]

## UNDERSTANDING OF EXHIBITION CONTENT

### UNDERSTANDING OF CONNECTION BETWEEN GREEN BY DESIGN AND VIEW FROM SPACE

The evaluator showed interviewees a generalized floor plan of the exhibitions. Most said they had not visited all of the exhibit sections, including about one-quarter of interviewees who said they had either not stopped or “breezed right through” *View from Space*.

The evaluator asked those who said they had visited both *View from Space* and *Green by Design* how the sections related to each other. Most interviewees cited energy conservation as the general connection between the different exhibit areas (see the first quotation below.) A few interviewees specifically mentioned the connection between alternative energy and the reduction of carbon emissions and global warming (see the second quotation). Two interviewees said that the *View from Space* area addressed “the problems” and that *Green by Design* offered possible “solutions” (see the third quotation).

(In what ways, if any, do the different sections relate to one another?) They're all looking at energy conservation. They're about green technology and how we can help our planet. [female, 16]

The sections all relate because they're about reducing the effects of greenhouse gases through the use of green energy products that don't generate a large carbon footprint. [male, 57]

There seem to be two different sections: There's one about seeing earth as a singular, whole system. The other section is basically about energy and innovation and development toward clean, non-polluting approaches. [male, 26]

Interviewees offered similar responses when asked what messages they took away from visiting *Green by Design* and *View from Space*. Nearly all interviewees said the exhibitions were about “energy conservation” and the use of “earth-friendly,” “renewable,” or “green” energy sources. One interviewee described ideas closely aligned with climate change and global warming in relating the messages of the exhibitions (see the quotation below).

Really what this is all about is energy conservation and the need to explore green energy. The climate is changing quickly. The glaciers are melting and we better figure out how to turn the tide. No more SUV's and the rest of it. [female, 22]



## PERCEPTION OF THE TECH AWARDS

Nearly one-half of interviewees said they did not stop at The Tech Museum Awards at the back of the *Green by Design* gallery. The evaluator asked those interviewees who had visited that area what they thought The Tech Museum Awards celebrate. Most interviewees responded with general terms synonymous with creativity including “innovation” and “human ingenuity.” Several interviewees offered more specific responses including that The Tech Museum Awards honor innovation in “environmental-friendly” technology (see the first quotation below). A few said the Award celebrates technology that aids humanitarian efforts in developing countries (see the second quotation). A few others said they could not remember what The Tech Museum Awards celebrate even though they indicated that they visited that area of the exhibition.

I think it [the Award] is celebrating companies or individuals who are trying to find innovative ways to have low impact on the environment. [male, 30]

I would say the Award celebrates good technology and inventions that can be used in not-so-developed countries for humanitarian efforts. [female, 47]

## RESPONSE TO ENVIRONMENTAL MESSAGES

### UNDERSTANDING OF ENVIRONMENTAL MESSAGES AND GREEN DESIGN

When asked what they found out about technology and environmental conservation from visiting the exhibitions, most interviewees said that they did not learn any new information that they had not been previously exposed to either in school or through the media (see the first and second quotations below). However, some interviewees indicated that the Make the Switch to Energy Efficient Lighting exhibit raised their awareness about the efficiency of compact fluorescent light bulbs (CFLs) and LED lights (see the third quotation). Two interviewees said that they learned something about solar panels (see the fourth quotation below), while one said that the technology presented in the Regenerative Braking exhibit was new information to him. Another interviewee mentioned that she had never seen the devices presented in The Tech Museum Awards area.

Well, I wouldn't exactly say that any of this was new information. We've learned most of this already in school. \*Yeah, we watched Al Gore's movie and there's been a lot of talk about energy conservation and green stuff. [male, 20; female, 19]

I've heard a lot about this before. I pretty much had a good idea of everything here. Nothing was brand new, but I think it's great you're [The Tech Museum] tackling environmental issues. Technology doesn't exist in a vacuum. [male, 50]

That light bulb display was pretty good. Those other kinds of lights are much more efficient. I should switch to those twisty light bulbs [CFLs] or maybe those other ones, the LEDs. I didn't know that I could use those at home. [female, 55]

I hadn't seen the concentrator solar panels before. I guess I knew that there were different kinds of solar panels, but I didn't realize there were ones that use a much smaller amount of silicone. [male, 46]

Interviewees offered similar responses when the evaluator asked what they found out about green design from visiting *Green by Design*. Although most said they did not learn anything new about green

design, a few interviewees mentioned regenerative braking, solar panels, LED lights, or alternative types of insulation as topics they learned about in the exhibition (see the first quotation below). A few interviewees said they were not familiar with the term “green design” (see the second quotation).

I didn't know you could use different kinds of fibers like wheat as insulation. \*Oh, yeah, right, and I had never heard of the LED bulbs and that regenerative braking stuff was new to me. [male, 49; female, 47]

(What, if anything, did you learn about green design?) I don't know. Sorry, but I don't know what you mean. Are you talking about designing a house and how to conserve energy or about how that wind and water stuff works back there [point to Harnessing Energy exhibit area]? (Are you familiar with the term “green design?”) No, not really. [female, 62]

### OPINION ABOUT PRESENTATION OF ENVIRONMENTAL MESSAGES

The evaluator asked interviewees their opinions about how the environmental issues presented in *Green by Design* and *View from Space* were discussed—specifically, whether they thought the presentation was balanced or biased. Most interviewees said they thought the information was presented in a balanced way (see the first and second quotations below). In contrast, a few interviewees commented that the exhibition did not address the environmental impacts of producing and disposing of green technology (see the third and fourth quotations). A few interviewees commented that the exhibitions did not present enough information about environmental issues and how green technology can address them (see the fifth quotation). None of the interviewees specifically mentioned the information presented in *View from Space*.

I thought the information was good. It [the information] was pretty balanced. It [the exhibition] gave information—the facts—and people are free to make their own choices about these issues. [female, 47]

The information was pretty balanced. There wasn't really a negative slant. Like, for the light bulb comparison it wasn't saying that you're bad if you use a certain kind of light bulb. It was just showing that some kinds are more efficient than others. [female, 23]

I think one of the things that is missing and, therefore, makes it seem a little biased, is information about the environmental impacts of some of these technologies like the silicon used for solar panels, the production and storage of batteries, and the mercury issue when disposing of fluorescent lights. There are environmental issues associated with green energy generation. I think that should be transparent here. [male, 50]

I think it's a little biased in that it doesn't really show, except for that light bulb comparison, the difference between the green approach and the conventional technology. I'd like to see more facts about the differences in both energy use and cost. I think you need to compare apples to apples. [female, 49]

Frankly, there didn't seem to be enough information about the environmental issues. It [the exhibition] didn't really talk about why we need to conserve energy and come up with cleaner solutions. It showed the what, but it didn't really talk about the why. [male, 46]

### INTEREST IN PRESENTATION OF ADDITIONAL ENVIRONMENTAL TOPICS

When asked what environmental topics they were interested in learning more about, interviewees offered a range of suggestions. Some interviewees said they would like to know more about the cost

and energy comparisons between different technologies such as solar panels (see the first quotation below). Several said they wanted to know more about the production, use, and disposal lifecycle of certain green technologies (see the second quotation). Similarly, several others said they wanted to know more about recycling and waste management (see the third quotation), and a few interviewees suggested the Museum include exhibits about alternative biofuels (see the fourth quotation). Other topics a few interviewees suggested included water conservation and purification, pesticides and genetically engineered food, and sod-covered “living” roofs. One interviewee who visited the *View from Space* area said she would like to know more about global warming.

It would be helpful to see some comparisons of the different technologies. Like, with the solar cells, which ones are more energy efficient? It [the Photovoltaic Cell exhibit] doesn't give any comparison of cost per output. [male, 50]

It seemed like it [the exhibition] talked a lot about energy consumption, but it didn't really go too much into green design in terms of manufacturing and waste disposal. I'd like to know more about how some of these products are made and where do they go when they're thrown out? [male, 22]

I'd like to know more about recycling and reusing waste products. (Anything in particular?) Well, I know there are a lot of building products that are made from recycled materials. I'd like to know more about those as well as what's happening with our landfills. Where does all the waste go? Eventually, we're going to run out of room for all our garbage, right? [female, 47]

There's a lot happening in the world of biofuels these days. It would be good to see that kind of information here. Like what's the difference between ethanol and biodiesel? Are biodiesel cars better than hybrids? [female, 26]

## PRINCIPAL FINDINGS: TELEPHONE INTERVIEWS

RK&A conducted telephone interviews with adults who had visited *Green by Design* and/or *View from Space* in winter and spring 2008. A total of 129 telephone numbers were collected from visitors as they exited the exhibitions, from which a random sample of 50 visitors was selected for telephone interviews. Interviews were conducted in March and April 2008, approximately two to three weeks after an interviewee's visit.

### VISITOR DEMOGRAPHICS

Slightly more than one-half of interviewees were male ( $n = 26$ ) and less than one-half were female ( $n = 24$ ). Interviewees ranged in age from 21 to 75, with a median age of 49. Of the 242 visitors approached for telephone numbers, 113 declined participation, for a 47 percent refusal rate.

Thirty-one (62 percent) of the 50 interviewees were visiting The Tech Museum for the first time, and the remaining 19 were repeat visitors (38 percent). Of those 19 interviewees, eight had visited twice in the past year, six had visited three times, and five had visited four or more times.

One-fifth of the interviewees were current members ( $n = 10$ ), six were recent members (joined in the past six months), two had been members for two to five years, and two were long-time members (six or more years). Nearly one-half of the 40 non-members cited distance as a barrier to membership. Several interviewees said they could not think of anything that would incite their interest in becoming a member of The Tech Museum, while others said they were already members of other institutions (e.g., the Monterey Bay Aquarium, the Children's Discovery Museum) and were not interested in joining another museum. A few interviewees said they would be interested in a membership to The Tech Museum if they knew more about the benefits of membership, offered memberships for children, there was more variety in the exhibitions, or if the exhibitions were geared for young children (2 years old).

### OVERALL VISIT TO THE TECH MUSEUM

Interviewees were asked about their overall visit to The Tech Museum. Most responded favorably and used words such as "good" and "great," with a few using more emphatic words such as "outstanding" and "amazing." Several interviewees expressed that they enjoyed the interactivity of the hands-on exhibits (see the quotation below), and a couple appreciated the cleanliness of the Museum. When probed about their initial responses, interviewees praised specific exhibitions or features, with the IMAX theater being most frequently cited as a favorite aspect.

(Overall, how was your visit to The Tech?) It was outstanding. (What was outstanding about it?) The interactivity, of course, is the key, particularly if you're trying to keep four kids involved. I thought it was just great . . . the opportunity to actually get in there and work on stuff.  
[male, 74]

Conversely, some interviewees expressed negative opinions. Several were disappointed that the exhibitions were not more up-to-date, and a few encountered broken exhibits during their visit (see the first and second quotations below). One interviewee said she desired more information and text in the exhibitions (see the third quotation).

(Overall, how was your visit?) Pretty good. (Can you tell me a little more about that?) Overall,

it's a great museum. The exhibits are really high quality, but they could stand to update a few of the exhibits or just fix some of the ones that are breaking down. [male, 40]

I was a little disappointed; I thought maybe they were about four years behind. It would have been a little nicer to be about two years [behind]. [male, 63]

(Overall, how was your visit?) It was fair. (What was fair about it?) I was there by myself with no kids, [and] a lot of the exhibits are hands-on [and] very much oriented towards little kids . . . versus just things to read or things that an adult would be interested in reading. . . . So that's why it was fair. [female, 45]

## RESPONSE TO *GREEN BY DESIGN* AND *VIEW FROM SPACE*

### RECOLLECTION OF THE EXHIBITIONS

After interviewees were reminded of the location of the exhibitions and of the general sections in *Green by Design* and *View from Space*, they were asked what they recalled. Nearly two-thirds of interviewees remembered the Harnessing Energy exhibits in *Green by Design*, and over one-half mentioned the *View from Space* projection globe (see the first two quotations below). About one-quarter remembered the electric vehicles, while the following exhibits were each mentioned by a few interviewees: solar panels, Bright Ideas interactive (see the third quotation), Light Bulb interactive, and Supercapacitor interactive.

I enjoyed seeing the kids there because they were trying to figure out how the wind power worked and the solar [power]. I thought it was an excellent display, especially for children, to understand how energy is concentrated with the reflection of the mirror [to] make the solar [panels] work and then the windmills—that turning the blades at a certain angle make[s] them capture the power of the wind. It was an excellent display. [female, 60]

One of the things that made a lasting impression on all three of us, my husband, my son and myself, is the interactive globe that enabled us to look at where the heat elements are, where the weather elements are, [and] where the environmental elements are. We were really impressed with being able to visually see on a planet replication what's happening to earth if we all don't get with it and do some[thing about the] environment. [female, 44]

I liked the bicycle and seeing how much harder you have to work to run an air conditioner compared to a fan or a light bulb, a regular incandescent, compared to [a] compact fluorescent. I [also] thought that the electric cars were really cool—just to see them. [female, 35]

### VIEW FROM SPACE

Interviewees were asked whether they recalled using the computer kiosk in *View from Space* and if so, how it had impacted their experience with the projection globe. Similarly, if they attended a Global Climate Change presentation, they were asked to discuss what they remembered from the program.

#### COMPUTER KIOSK

Three-quarters of interviewees had not used the kiosk, some of whom did not recall seeing it outside theater. One-quarter of interviewees recalled using the kiosk. When asked what happened when they used it, several recounted that they were able to choose from the thematic sections featured on the computer screen; a few remembered specific themes such as the wind patterns, hurricanes, typhoons, water currents, and the El Niño effect (see the quotation below). A few others recalled general concepts, usually referring to weather patterns that had appeared on the globe.

(Did you happen to use the computer kiosk in front of the theatre with the giant globe?) Yes, we did. (As you used the kiosk, what did you see happen?) We tried watching a bunch of the movies, basically. (Can you describe what that was like?) It was really fun. I got to look at the El Nino [effect]. . . . We looked at most of the movies that were on that kiosk. [male, 52]

Most interviewees who had used the kiosk remembered its positive effect on their experience, welcoming the opportunity to manipulate the display on the globe (see the first two quotations below). In contrast, a couple of interviewees had tried to use the kiosk, but could not load it properly (see the third quotation). One interviewee was unsure of the relationship between the kiosk and the globe, while another was overwhelmed by the amount of content and confused about the exhibit's main message (see the fourth and fifth quotations).

(As you used the kiosk, what did you see happen?) I think it was about typhoons. We did it several different times . . . different typhoons that have happened in the world, and [we] watched the impact across the oceans and the different land masses. Then we thought back to what we remembered from the news [about] various events, so that was probably the thing we were most intrigued with. [female, 53]

The color gradations really made a big impact on us. I think any time that you can take something you've heard [about] and put it in a visual, [it has an impact]. Being able to manipulate it ourselves . . . was really great for us. [female, 44]

(Did you happen to use the computer kiosk in front of the theatre with the globe?) Yes, and it wasn't working. (Do you recall what was happening to it?) It kept saying it was loading, . . . but then it never loaded, and then nothing ever changed on the globe. [female, 42]

When there's not . . . someone giving a presentation, I [saw] people kind of drifting [in] and look[ing] around. . . . I don't think it's obvious that you can run the thing yourself, so there may be a lost opportunity there. . . . [There needs to be] some kind of arrow saying 'Have fun here' or something like that. [male, 54]

It was like a 15-minute feature film, but it was a lot of different thoughts and I don't remember any one thing sticking out. I mean it was like they were trying to cover too much subject matter at one time. (Were there any overall ideas or messages that you took away from that presentation?) No, unfortunately. It was entertaining but when we walked away, it was like, 'What was the message?' and 'What was the purpose?' [female, 51]

### **GLOBAL CLIMATE CHANGE PRESENTATION**

Two-thirds of interviewees did not attend the Global Climate Change presentation in the *View from Space* theater. The other one-third experienced the presentation and most recalled various aspects of the program. Similar to the responses about their experience with the computer kiosk, interviewees often praised specific topics that were discussed in the presentation, for example, hurricanes, trade winds, fires, global temperatures, and energy consumption (see the quotations below). In contrast, a few interviewees could not recall anything specific about the presentation.

(What, if anything, do you recall from that presentation?) I don't know that I got anything more out of it than I [did] when I [used the kiosk] the first time we went to the Museum, [but] it was better because it was somebody else describing it for the grandkids. . . . She pointed out Hurricane Katrina . . . and she did explain a few more things about the poles, trade winds, [and] cyclones—that I didn't point out to the kids. [male, 64]

I definitely remember the fast forwarding [of] temperatures over the last few years. . . . You can definitely see things like spots on the Pacific which [were] blue and then over time some of the spots start heading green and then to yellow and then [you] see El Nino and La Niña come up. . . . I could actually picture it in my mind what was going on there. . . . Global warming is a massive numbers and trends and statistics [concept], and to be able to literally wrap it around a theater in front of you and run through it in fast time; that definitely works. [male, 54]

## UNDERSTANDING OF EXHIBITION CONTENT

The evaluator asked interviewees what ideas or messages they gleaned from their experiences in the exhibitions and the Global Climate Change presentation, if they attended it. Most interviewees discussed specific information learned from *Green by Design* exhibits, *View from Space* exhibits, or the Global Climate Change presentation, rather than a holistic sense of these elements combined—even though many had used multiple offerings. In contrast, several interviewees said they did not learn anything, having spent little time in the exhibitions or having had difficulty understanding the presentation.

### GREEN BY DESIGN

Multiple interviewees mentioned either alternative energy sources or the conservation of energy as core themes of the *Green by Design* exhibits (see the first quotation below). A few specified that the Harnessing Energy exhibits gave them a clearer sense of how alternative energy sources are produced (see second quotation below). A couple of other interviewees said the exhibits reinforced ideas about the “green movement” and conservation, in general (see the third quotation).

The message is that energy is something which is more and more demanded and there is less and less energy, so we have to [conserve] energy and try to find other ways to produce it. [male, 48]

(What were some ideas or messages that you took away from these exhibits?) One thing that I like is the rather simple ways [that were used] to demonstrate some fairly complex ideas. I thought that was good by virtue of just having the hands-on experience of being able to play with it . . . and get different results. (You referred to some complex ideas that were part of the exhibit. What did you consider those ideas to be?) I suppose the whole idea of using available resources of wind, water and so forth to create energy. [male, 74]

I think the whole idea of the green movement in the schools was reinforced. My son has been studying that at his own school; they had a green month where they all did things in the home and in the school to conserve and compost . . . and so a lot of [those] ideas were reinforced. [female, 40]

### VIEW FROM SPACE

Interviewees took away a range of messages from *View from Space*. A few were struck by the global perspective that the projection sphere gave them (see the two quotations below). Others remembered specific points; for example, one interviewee recalled, “I did not realize [that] hurricanes originated in the other hemisphere.” In contrast, a couple of interviewees mentioned broad themes, one noting that *View from Space* focused on recycling and the other commenting that he had learned about the global climate.

I'm trying to remember more specifically, but I think whatever it was that is being shown on the globe, whether it's fluidity of land or changes in continents or just electricity grids . . . you don't see the national boundaries. You see continents and [the] interconnectedness of things and it can cover things in a much more unified manner. It makes a lot more sense than the way we break things down. It transcends those artificial boundaries that are used to present information. [female, 45]

It gave the kids another perspective on the earth and solar system and how it all fits together in a way that you can't really get from a two-dimensional book, so they enjoyed seeing those different perspectives and understanding how things fit together. [female, 34]

## GLOBAL CLIMATE CHANGE PRESENTATION

Interviewees who attended the Global Climate Change presentation were asked to discuss its main messages. Most gleaned environmental messages, ranging from specific topics broached in the presentation (see the first and second quotations) to a few direct references to global warming or global climate change (see the third quotation). One interviewee said she left the presentation with a hopeful message: individual actions can curb global warming (see the fourth quotation).

(What were some ideas or messages that you took away from that presentation?) The one about the forest being burned and part of the world being burned—that was new to me . . . and the energy consumption, especially in America and Europe. [female, 67]

Without fresh water coming from the sky, we're going to be in trouble. (That's really interesting. Can you expand on that a little bit?) I don't think people realize that the ocean recharges the entire globe, and that the whole world is involved in this, not simply one country or one government or one belief. All of us depend on the oceans—period. For that reason, we should all cooperate . . . because if we ruin the ocean, we don't hurt just ourselves, we hurt everybody. [female, 69]

(What were some ideas or messages that you took away from this presentation?) Global warming. . . . It's abundantly obvious that the globe is getting warmer and that hurricanes are more common and it helped give a nice visual representation of weather patterns. [male, 52]

It's not too late to change, and it was interesting. . . . Basically, the way they end [the presentation] is, "This is what [it would look like] if things were to continue this way," and he showed how the temperature would increase. . . . [But] it's not too late, and you can do your part to change. [male, 46]

In contrast, a few interviewees did not glean any messages from the presentation. A couple of interviewees noted that they were unable to focus on the presentation's content because of where they were sitting or because it was difficult to see the red laser light pointer used by the presenter (see the quotation below).

(What, if anything, do you recall from this presentation?) Constructive criticism would be that she used a red light to highlight what she was talking about on the globe [and] it was incredibly difficult to see the red light. . . . To use the red laser pen would be effective if the globe or the room had different lighting. (What were some ideas or messages that you took away from that presentation?) I think the fact that I can't really recall them is [related to] the fact that we were struggling to really follow what she was saying. [female, 44]



## RESPONSE TO ENVIRONMENTAL MESSAGES

### UNDERSTANDING OF GLOBAL CLIMATE CHANGE, TECHNOLOGY, AND CONSERVATION

The evaluator asked interviewees what they had learned about global climate change, technology, and environmental conservation from the exhibitions and presentation. About three-quarters of interviewees were able to describe an environmental message to varying degrees. Some interviewees discussed issues related to energy conservation or alternative energy sources, with responses ranging from specific information learned to general concepts (see the first two quotations below). An equal number of interviewees mentioned global warming—either in literal terms, referring to the global increase in temperatures, or in a more comprehensive sense (see the third and fourth quotations). A few interviewees discussed global climate change and potential solutions (e.g., alternative energy sources) (see the fifth quotation). A few others acknowledged the environmental messages and praised the Museum for educating children about these topics, but said they had not learned anything new.

I'm already familiar with some of the concepts. I guess just seeing it on a very elementary level . . . how it works, how solar energy for instance is converted into power, and how wind power is converted into energy. I can remember the display with the light bulb. . . . I guess I learned about other sources of power that are renewable. [female, 60]

Certainly we took away the importance of alternative fuel sources and the importance of being green. [female, 51]

The temperature is increasing, and they were talking about [how] the average weather in the Bay Area could be in the mid to high 80s all the time. [male, 46]

(Based on your experiences in the exhibition as a whole and in the theater, what if anything did you find out about global climate change, technology, and environmental conservation?) What a difference the wetlands make. (Can you tell me a little bit more about that?) That besides the chemicals . . . we're putting in our air, the global warming means more ice . . . unfreezing and just . . . what the Everglades have done is to [counteract that]. Now it seems to be worse . . . because the Everglades aren't able to continue at the rate they were at. [female, 55]

I've been exposed to those problems before through work, so I knew about it before, but it definitely highlighted a lot of the problems that we're facing right now with global warming. (And what in particular did you learn about global warming?) The fact that the temperatures across the world [are] causing weather changes. I think the globe display was great in reminding [me] about what can happen, and what are the ways that we can try to slow it down . . . by moving to solar panels and energy efficient devices—that kind of stuff. [male, 28]

In contrast, one-quarter of interviewees had no recollection of the environmental content, either taking away general earth science information (see the quotation below) or no messages at all.

I don't know that I came away with that much. It was sort of informative in how the earth works and the storms and stuff like that, . . . but I don't remember her covering things like the polar caps are decreasing their mass. I didn't look at [it] so much as a global warming exercise but 'Here's how the earth works; here are the things that happen to it.' [male, 64]

### OPINION ABOUT PRESENTATION OF ENVIRONMENTAL MESSAGES

Interviewees who perceived an environmental message in *Green by Design* and *View from Space* were asked their opinion of The Tech Museum addressing such issues. Nearly all interviewees were in favor of the

Museum addressing environmental topics. Some said the presentation of environmental issues is part of the Museum's mission, while others emphasized the important role the Museum can play in educating children (see the first two quotations below). Several praised the practical solutions that were conveyed in the exhibitions (see the third quotation). A few interviewees expressed that they would like to see the Museum address environmental issues more often or more thoroughly (see the fourth and fifth quotations).

(What is your opinion about The Tech addressing environmental issues?) It's very important. I think that's one of the messages or reasons for The Tech—to talk about [the] science that we need to know so we can incorporate changes in our own life. [female, 67]

I think it's really great. Silicon Valley is moving into a whole green leadership position so I think they ought to be doing this kind of thing. The more we educate the kids . . . they're going to be the ones to lead the way. [female, 40]

It's an issue that can't be ignored, so the fact that The Tech Museum is taking up a big part of their floor space to educate the children and also people just coming through—I think that's certainly really important. . . . It just makes you think of how . . . if you build your next house what you're going to fold into that structure. [female, 51]

Do it more. Make more exhibits where the children can understand what they do and how it impacts or benefits the planet. [female, 44]

Today, in general, environmental issues are a rather colossally important thing. . . . Environmental issues are complicated . . . and you can't make the complexity of this problem go away if you don't burn coal [and] if you don't burn oil. You could have ocean turbines, but those are going to chew up the fish, you can have wind turbines, but those are going to be a blight [and] may well change wind patterns and will certainly chop up the birds. . . . It really is a vastly interconnected and very problematic thing. . . . I think the best service The Tech could do to the public is to explain the alternatives, explain the trade-offs, explain the interconnections, and then leave it at that. [male, 54]

Only a couple of interviewees expressed that they were either not interested in the subject matter or did not believe it was the Museum's responsibility to address environmental issues (see the quotation below).

(What is your opinion about The Tech addressing environmental issues?) Environmental issues [are] just one part of The Tech museum, because it also has all the other exhibits—so it's more a balanced approach to all the different aspects. (Do you have any particular feelings about The Tech addressing environmental issues?) No, I don't think that's the purpose of a tech museum. It should be more educating in a broad sense. [female, 75]

### **ACTIONS TAKEN AFTER THEIR VISIT**

Interviewees who sensed an environmental message in the exhibitions were also asked whether they had taken any actions to address environmental issues following their visit. Most interviewees said they had not done anything new that they were not doing previous to their visit. However, several interviewees credited their visit with heightening their awareness of environmental issues, reinforcing existing pro-conservation behavior, or generating thoughts related to making green choices (see the quotations below).

Based on our environment where we live, when we remodeled our home, we used good products that addressed, not necessarily that they were green, but they addressed better windows to hold heat in the house so you were heating less and [getting] better insulation. . . . I was interested in the windmills because being on the ridge I keep on thinking that maybe I'll put up a self-energizing windmill to generate electricity . . . so I learned a little bit more about that. [male, 63]

We were already doing all the compact fluorescents in the house . . . and it's likely that our next vehicle we buy will either be a hybrid or some other form of high-efficiency vehicle, but just in general, it's insulation in the attic, little things like that start to pop into your mind. How can I make it more efficient and use less? [female, 35]

We're taking our own bags now to the grocery store. I felt very passionate about it even before I went, but going there just gave me firmer [reason] to do [so], particularly to recycle more. Now I'm thinking about things like, [I] used to throw out old jeans, [because] I didn't know what to do with them. It makes me think about those things, 'Don't throw something in the garbage' and 'Can it be recycled?' [female, 34]

I'm not sure how much of an effect that played, but I've been more conscious of the energy that I used in the past few weeks. . . . Turning off lights more quickly than is my pattern and thinking about getting in the car versus getting on my bicycle. What's come up for me is more awareness that I used to have [that] kind of drifted away. So I imagine that The Tech was part of that. [male, 64]

# APPENDICES

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## APPENDIX A

REMOVED FOR PROPRIETARY PURPOSES

**APPENDIX B**

**REMOVED FOR PROPRIETARY PURPOSES**

**APPENDIX C**

**REMOVED FOR PROPRIETARY PURPOSES**

## APPENDIX D

### LIST OF STATISTICAL ANALYSES RUN ON THE *VIEW FROM SPACE* AND *GREEN BY DESIGN* TIMING AND TRACKING DATA

#### ***MANN-WHITNEY U***

Gender	Total time
Ages (3 groups)	Total stops
Visiting with children	Time spent in <i>GBD</i>
Level of crowding	BY Number of stops made in <i>GBD</i>
Day	Time spent in <i>VFS</i>

#### ***CHI-SQUARE STATISTIC***

Gender	Use of Tech Tags
Ages (4 groups)	Staff interactions
Visiting with children	BY Use of three-sided panels
Level of crowding	Visitation to <i>GBD</i>
Day	Visitation to <i>VFS</i>
	Use of <i>VFS</i> kiosk

**APPENDIX E**

**REMOVED FOR PROPRIETARY PURPOSES**