



Museum Visitor Studies, Evaluation & Audience Research

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Exhibition Evaluation

Summative Evaluation of *Giant Worlds*

Prepared for the
The Space Science Institute
Boulder, CO

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EXECUTIVE SUMMARY

PRINCIPAL FINDINGS: TIMING AND TRACKING OBSERVATIONS

Data were collected at the Orlando Science Center (OSC) in June and July 2008¹. The evaluators observed a total of 100 drop-in visitors ranging in age from 8 to 13.

OVERALL VISITATION PATTERNS

- ◆ Observed visitors' total time in the exhibition ranged from 1 minute to 52 minutes, and the median time was 9 minutes.
- ◆ Total number of exhibits at which visitors stopped ranged from 1 to 14, and the median was 6 exhibit stops.

VISITATION TO INDIVIDUAL EXHIBITS

- ◆ Exhibits with the highest visitation were Friend or Foe (70 percent) and Secrets of the Bulge (51 percent).
- ◆ Exhibits with the highest median times were: Giant Worlds Odyssey (median time = 3 minutes, 58 seconds), Magnetic Attraction (median time = 2 minutes, 52 seconds), and Planet Challenge (median time = 2 minutes, 6 seconds).

VISITOR BEHAVIORS

- ◆ Exhibits with high visitor interaction included: Seeing the Unseen (89 percent), Planet Challenge (74 percent), Magnetic Attraction (71 percent) and Tools of the Trade (71 percent).
- ◆ 99% of visitors interacted with others while using exhibits in the exhibition.
- ◆ 46% of visitors misused one or more exhibits.

PRINCIPAL FINDINGS: INTERVIEWS

Data were collected at the Orlando Science Center (OSC) in June and July 2008. A total of 31 interviews were conducted with individuals ranging in age from 8 to 13 years.

OVERALL OPINION OF THE EXHIBITION

- ◆ One-half of interviewees said they liked the exhibition or described the exhibition as “cool” or “awesome.” Some interviewees said the exhibition was educational and some others said it was fun.
- ◆ When asked what activity they liked most, approximately one-third of interviewees liked Planet Challenge, and some liked Magnetic Attractions and Seeing the Unseen. Other responses were idiosyncratic.
- ◆ Approximately one-third of interviewees said they liked activities in which they learned something or were shown something new (or surprising), and approximately another one-third could not explain why they liked specific activities. Some interviewees explained that they liked challenging activities.

¹ The *Giant Worlds* exhibition shared a space with three non-related exhibits, Hurricane Simulator, Tornado Simulator, and Science on a Sphere. Though visitors stopped at these exhibits as they visited *Giant Worlds*, all three are excluded from this report.

- ◆ One-third of interviewees did not think any exhibits were least interesting. Some named specific exhibits such as Tools of the Trade, Extreme Seasons, Friend or Foe, Magnetic Attractions, and Planet Plunge.
- ◆ Only a few interviewees explained why an activity was least interesting, and of these, the majority mentioned interactives, stating there were not enough interactives or the interactives were not challenging enough.

INTERACTION WITH STAFF

- ◆ Slightly less than one-half of visitors said they interacted with staff.
- ◆ Of those, some interacted with staff at exhibits not related to the exhibition, and few did not specify the nature of the interaction. Only a few cited interaction specific to the exhibition, naming Friend or Foe and Planet Challenge.

COMPREHENSION

- ◆ When asked what they thought the exhibition was trying to teach kids, many interviewees said planets, space, the Solar System, or the Universe. A few interviewees responded that they did not know and a couple interviewees each said the exhibition was about science or new things.
- ◆ Many interviewees successfully recalled something they learned about giant planets from the exhibition. Of these, the majority remembered learning about the size of the giant planets and that the giant planets are gaseous. Other recollections included information about the giant planets' moons and relative location in space. Some did not respond, and a few said they learned nothing about giant planets.
- ◆ Some interviewees said the exhibition did not affect the way they think about Earth. Some others said it did, giving specific examples, stating that they gained perspective about the size of Earth, learned that giant planets affected the physical characteristics of Earth, and learned that oxygen was unique to Earth.
- ◆ When asked how scientists know what they know about the giant planets, less than one-half mentioned specific instruments such as satellites, telescopes, and probes. Some said that scientists go to space, and some did not respond. A few interviewees said that scientists learn from research, and a few said that they learn from pictures.

FEELINGS AND CURIOSITIES

- ◆ Many interviewees said they felt like a scientist or explorer in the exhibition although only some interviewees could name a specific exhibit where they felt this way. Those who mentioned a specific exhibit named Tools of the Trade, Planet Challenge, and Light Probe.
- ◆ When asked whether they left with any questions and curiosities, many interviewees said they did not. Of those who responded affirmatively, a couple wondered about the moons, and a couple wondered generally about the planets and stars.

DISCUSSION

Findings from the summative evaluation of *Giant Worlds*, conducted for the Space Science Institute (SSI), indicate that the exhibition was both educational and engaging for the target audience, children 8 to 13 years old. Most notably, children took away new information about the giant planets, and interaction between children and adults and other children in the exhibition was high. However, there were some barriers to achieving the exhibition's intended impact. Implications of the findings are discussed below.

IMPACT AND EFFECTIVENESS OF THE EXHIBITION

TIME SPENT IN THE EXHIBITION AND USE OF EXHIBITS

Overall, *Giant Worlds* was an effective exhibition. Children spent a median time of 9 minutes in the exhibition. Since RK&A tracked only children ages 8 to 13 years, it is not possible to compare *Giant Worlds* to other exhibitions using Serrell's "Sweep Rate Index" or "Percentage Diligent Visitor Index" (Serrell, 1998). Nevertheless, when compared to time data in which children were tracked, time spent in *Giant Worlds* is greater than that at comparable exhibits at children's museums (RK&A, 2008; RK&A, 2004). In addition, time spent in the exhibition is only slightly less than comparable exhibits in which adults *and* children were tracked (RK&A, 2006b).

Additionally, since the formative evaluation of *Giant Worlds* in 2006, SSI reworked some of the exhibits, changing Planet Challenge, Friend or Foe, and Planet Plunge, among other exhibits; these changes seem to have enhanced visitors' experiences in the exhibition (RK&A, 2006a). All of the children interviewed for the summative evaluation liked the exhibition and most children did not find any exhibits boring or difficult to use or understand. Functionality of the exhibit components was excellent, with the majority of visitors using the exhibit components as intended.

By and large, children enjoyed and learned much from interactive exhibits that challenged them. For example, children liked the exhibit Friend or Foe; one child explained that he liked that it took a few tries in order to see how the giant planets could protect or be detrimental to Earth. Challenging exhibits, which include Friend or Foe and Planet Challenge, had the highest visitation, highest median times, and highest interaction between visitors, and they were also preferred in the formative evaluation of *Giant Worlds* (RK&A, 2006a). Furthermore, a few visitors to *Giant Worlds* requested even more challenges. Past evaluations confirm this finding, noting that visitors enjoy challenging experiences (RK&A, 2008; RK&A, 2006a).

CHILDREN'S UNDERSTANDING

When prompted, children mentioned several different ideas about giant worlds, making comparisons between the giant planets and other planets. Specifically, children learned that giant worlds are gaseous planets, much bigger than Earth, and are far from the Sun. This finding is encouraging as children often answer very generically and are unable to recall specifics even when prompted (RK&A, 2006a).

Nevertheless, while children learned about the giant planets, their understanding often did not directly address the three learning objectives: 1) Earth and the giant planets are connected in many ways, such as weather and volcanoes—in fact, the giant planets were instrumental in the formation of Earth; 2) Each giant planet changes over time, with seasonal and lifecycle changes; and, 3) We know what we know

about giant planets because of collaborative effort by scientists, engineers, programmers, students, and others—there is always more to learn. These learning objectives address complex ideas, and it is not surprising that children did not fully understand these ideas (RK&A, 2008; RK&A, 2006b).

One objective of specific interest, however, is the third learning objective. Data show that visitors did not frequently stop at exhibits related to scientists or spend much time at such exhibits. Interview data also revealed that children focused more on the instruments used to explore space, and did not express interest in the people behind these instruments. For example, at Tools of the Trade, children enjoyed looking through the telescope and a few children said that the exhibit made them feel like a scientist or explorer. However, few children stopped or spent much time at exhibits focused on scientists, like Teamwork: Mission Success. These results are not unique. In a summative evaluation of the exhibition *Magic School Bus Kicks up a Storm*, results show that children 5 to 10 years of age were more interested in the weather than the people behind the scenes, like meteorologists (RK&A, 2004). These results suggest that science ideas capture children’s interests more than those studying the ideas.

BARRIERS TO ACHIEVING INTENDED IMPACT

EXHIBITION LAYOUT

Findings show that the way the exhibition was installed at OSC may have impacted visitors’ experience. For example, at OSC, there were two entrances: the entrance through a central corridor (main entrance) and the entrance through the OSC exhibition *DinoDigs* (dinosaur entrance). Findings show that visitors entering through the main entrance, which included an introductory panel, spent more time in the exhibition and made more stops than those visitors who entered through the dinosaur entrance, suggesting that the latter visitors were not “properly” introduced to the exhibition and thus spent less time in the exhibition because they were not presented the “big idea.” In addition, at OSC, the exhibits were not grouped as SSI designed.

INTERACTION WITH STAFF IN THE EXHIBITION

SSI offers an education program for host museum educators. OSC staff took part in these workshops, yet did not follow through with the intended strategies. During data collection, there was no interaction between staff and visitors about the exhibition. For instance, SSI included an assortment of games and puzzles that were supposed to be available at a staffed table in the exhibition, but during the data collection period, which extended over a month, the games and puzzles were never brought out. While the reason for this is unclear, it seems likely that OSC simply did not have the staff available to take on the roles intended for *Giant Worlds*.

As SSI surely knows and intended to have happen, staff interaction with visitors can transform the visitor experience. As found in a summative evaluation of *Search for Life* at the New York Hall of Science, staff interaction did not just help convey the content of the exhibition; it excited visitors about the exhibition (RK&A, 2006b). RK&A commends SSI’s commitment to training host museum educators, as there is tremendous value to fostering staff-visitor interactions, and encourages SSI to continue offering education programs for host museum educators and to follow-up with educators to learn how to best use them as a resource for SSI exhibitions.

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INTRODUCTION

This report presents the findings from a summative evaluation of the traveling exhibition *Giant Worlds* conducted by Randi Korn & Associates, Inc. (RK&A) for The Space Science Institute in Boulder, Colorado.

Data were collected from June 2008 to July 2008 at the Orlando Science Center in Orlando, Florida. The evaluation documents the scope of *Giant Worlds*' impact and effectiveness. Specifically, the objectives of this evaluation are to:

- ◆ Determine the total amount of time visitors spend in the exhibition and in individual exhibits;
- ◆ Identify which exhibition components visitors visit most and least frequently;
- ◆ Examine the interactions that occur between children and other visitors;
- ◆ Examine the interactions between visitors and docents/educators in the exhibition;
- ◆ Identify visitors' affective experience in the exhibition (i.e., did it pique their curiosity or surprise them in any way?);
- ◆ Examine the extent to which visitors feel like scientists/explorers; and,
- ◆ Identify the meaning visitors take away from their experience, particularly whether they learn that:
 - ❖ Earth and the giant planets are connected in many ways, such as weather and volcanoes—in fact, the giant planets were instrumental in the formation of Earth;
 - ❖ Each giant planet changes over time, with seasonal and lifecycle changes; and,
 - ❖ We know what we know about giant planets because of the collaborative efforts of scientists, engineers, programmers, students, and others—yet there is always more to learn.

METHODOLOGY

RK&A used two data collection strategies to assess visitors' experiences in the exhibition: timing and tracking observations and onsite exit 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 in the exhibition and suggest the range of visitor behaviors.

Visitors between 8 and 13 years old 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 at one of the two entrances to *Giant Worlds* and observed the first eligible visitor to enter, following the selected visitor through the exhibition, recording the exhibits used, noting select behaviors, and logging total time spent in the exhibition (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 the exhibition.

For this evaluation, visitors were observed from two entrances: the entrance from the hallway (main entrance) and the entrance from *DinoDigs* (dinosaur). Thus, data collectors observed one eligible visitor from the main entrance, and once this observation was completed, observed the next eligible visitor from *DinoDigs* entrance; data collectors continued to observe visitors alternately from the main entrance and *DinoDigs* entrance.

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.

Upon exiting the exhibition, visitors between 8 and 13 years old were 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 interview guide).

DATA ANALYSIS

QUANTITATIVE ANALYSIS

Observation and tracking data are quantitative and were analyzed using SPSS 12.0.1 for Windows, a statistical package for personal computers. Analyses included both descriptive and inferential methods. Within the body of the report, only statistically significant findings ($p \leq .05$) are presented; however, all statistical analyses that were run are listed in Appendix C.²

DESCRIPTIVE STATISTICS

Frequency distributions were calculated for all variables. For ratio-level variables, such as "total time in the exhibition" the range and the median (50th percentile, the data point at which half the responses fall above and half fall below) were also calculated.³

INFERENTIAL STATISTICS

To examine the relationship between two categorical variables, 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. For example, "interaction with staff" was tested against "age group"

² When the level of significance is set to $p = 0.05$, any finding that exists at a probability (p -value) ≤ 0.05 is "significant." When a finding (such as a relationship between two variables) has a p -value of 0.05, there is a 95 percent probability that the finding exists; that is, in 95 out of 100 cases, the finding is correct. Conversely, there is a 5 percent probability that the finding does not exist; in other words, in 5 out of 100 cases, the finding appears by chance.

³ Medians rather than means are reported in this document because, as is typical, the number of exhibits used and the time spent by visitors were distributed unevenly across the range. For example, whereas most visitors spent a short to moderate amount of time in the exhibition, a few spent an unusually long time. When the distribution of scores is extremely asymmetrical (i.e., "lopsided"), the mean is affected by the extreme scores and, consequently, falls further away from the distribution's central area. In such cases, the median is a better indicator of the distribution's central area because it is not sensitive to the values of scores above and below it—only to the number of such scores.

to determine whether the two variables are related. To test for differences in the medians of two or more groups, the nonparametric Kruskal-Wallis (K-W) test was performed.⁴ For example, “total time in the exhibition” was compared by “age group” to determine whether time spent in the exhibition is age-related.

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

For the timing and tracking 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 gender and age is indicated in brackets. Trends and themes in the data are presented from most to least frequently occurring.

FINDINGS IN THIS REPORT ARE IN TWO MAIN SECTIONS:

1. Timing and Tracking Observations
2. Interviews

⁴ The Kruskal-Wallis (K-W) test is a nonparametric statistical method for testing the equality of population medians of two or more groups. Nonparametric statistical methods do not assume that the underlying distribution of a variable is “normal” with a symmetric bell-shape, so they are appropriate for testing variables with asymmetric distributions such as “total time in the exhibition”. The K-W test is analogous to a One-way Analysis of Variance, with the scores replaced by their ranks. The K-W test statistic H has approximately a chi-square distribution.

PRINCIPAL FINDINGS:TIMING AND TRACKING OBSERVATIONS

Observers timed and tracked 100 drop-in visitors between the ages of 8 and 13 as they visited the *Giant Worlds* exhibition. All observations took place in June and July 2008⁵.

DATA COLLECTION CONDITIONS

Observers tracked eligible visitors entering the exhibition from the main entrance (53 percent) and the dinosaur entrance (47 percent) (see Table 1). About half of the observations took place on weekdays (52 percent) and half on weekends (48 percent). Most observations were collected in the afternoon (85 percent). During observations, the exhibition's level of crowding tended to be low (45 percent) or moderate (42 percent).

TABLE 1
DATA COLLECTION CONDITIONS

CONDITIONS (n = 100)	%
ENTRANCE	
Main	53
Dinosaur	47
DAY OF THE WEEK	
Weekday	52
Saturday	33
Sunday	15
TIME OF DAY	
Afternoon	85
Evening	10
Morning	5
LEVEL OF CROWDING	
Low	45
Moderate	42
High	13

⁵ The *Giant Worlds* exhibition shared a space with three non-related exhibits, Hurricane Simulator, Tornado Simulator, and Science on a Sphere. Though visitors stopped at these exhibits as they visited *Giant Worlds*, all three are excluded from this report.

VISITOR DESCRIPTION

This section describes the characteristics of observed visitors and the group with whom they attended the exhibition.

DEMOGRAPHIC CHARACTERISTICS

Data collectors recorded the gender and approximate age of each observed visitor. As shown in Table 2, males outnumbered females (57 percent and 43 percent, respectively). Nearly one-half of observed visitors were 10 – 11 years old (45 percent), one-third were 8 – 9 years old (32 percent) and one-quarter were 12 – 13 years old (23 percent).

TABLE 2
DEMOGRAPHIC CHARACTERISTICS

CHARACTERISTIC (<i>n</i> = 100)	%
GENDER	
Male	57
Female	43
APPROXIMATE AGE (IN YEARS)	
8 – 9	32
10 – 11	45
12 – 13	23

VISITING GROUP

Data collectors recorded the number of adults and children in the observed visitors' group. Almost all observed visitors attended the exhibition in a multigenerational group of adults and children (94 percent) (see Table 3). The total number of people in the observed visitors' group (including the observed visitor) ranged from one to eight, with a median of four people in the group.

TABLE 3
VISITING GROUP

GROUP (<i>n</i> = 100)	%
GROUP COMPOSITION	
Adults and children	94
Children only	6
GROUP SIZE^{1, 2}	
One	2
Two	16
Three – Four	54
Five or more	28

¹Group size includes observed visitor.

²Group size ranged from 1 – 8; median = 4.

OVERALL VISITATION PATTERNS

This section presents information about observed visitors' total time in the *Giant Worlds* exhibition and total number of stops made in the exhibition.

TOTAL TIME IN THE EXHIBITION

Observed visitors' total time in the exhibition ranged from 1 minute to 52 minutes (see Table 4). Median time in the exhibition was 9 minutes, 36 seconds. One-quarter of visitors spent less than 5 minutes in the exhibition, 29 percent spent between 5 and 10 minutes, 32 percent spent between 10 and 20 minutes, and 15 percent spent 20 minutes or longer.

TABLE 4
TOTAL TIME IN THE EXHIBITION

TIME (MIN:SEC) (<i>n</i> = 100)	%
Less than 5:00	24
5:00 – 9:59	29
10:00 – 19:59	32
20:00 – 29:59	13
30:00 or more	2
SUMMARY STATISTICS	MIN:SEC
Range	1:06 – 51:59
Median time	9:36

FACTORS ASSOCIATED WITH TOTAL TIME IN THE EXHIBITION

Total time in the exhibition was compared by gender, age group, visit day, level of crowding, visit group size and exhibition entrance. There was one other significant finding (see Table 5).

- ♦ Visitors entering the exhibition from the main entrance spent more time in the exhibition (median time = 10 minutes, 44 seconds) than did visitors entering the exhibition from the dinosaur entrance (median time = 7 minutes, 32 seconds).

TABLE 5
TOTAL TIME IN THE EXHIBITION BY ENTRANCE

TIME IN THE EXHIBITION (<i>n</i> = 100)	ENTRANCE		
	DINOSAUR	MAIN	TOTAL
	MIN:SEC	MIN:SEC	MIN:SEC
Median time ¹	7:32	10:44	9:36

¹ $\chi^2 = 5.369$; *df* = 1; *p* = .021 (Kruskal-Wallis test)

TOTAL NUMBER OF EXHIBIT STOPS

The exhibition had 29 exhibits⁶. The total number of exhibits at which visitors stopped ranged from one to 14 with a median of six exhibit stops (see Table 6). Just over one-third of visitors stopped at 1 – 4 exhibits, 48 percent stopped at 5 – 9 exhibits, and 17 percent stopped at 10 – 14 exhibits.

TABLE 6
TOTAL NUMBER OF STOPS IN THE EXHIBITION
(EXCLUDING PRE-EXISTING EXHIBITS)

NUMBER OF EXHIBITS VISITED (<i>n</i> = 100)	%
1 – 4	35
5 – 9	48
10 – 14	17
15 or more	0
SUMMARY STATISTICS	EXHIBITS
Range	1 – 14
Median	6

FACTORS ASSOCIATED WITH TOTAL NUMBER OF EXHIBIT STOPS

Total number of exhibit stops was compared by gender, age group, visit day, level of crowding, visit group size and exhibition entrance. There was one significant finding (see Table 7).

- ♦ Visitors entering the exhibition from the main entrance stopped at more exhibits in the exhibition (median = 7 exhibit stops) than did visitors entering the exhibition from the dinosaur entrance (median = 5 exhibit stops).

TABLE 7
TOTAL NUMBER OF STOPS IN THE EXHIBITION BY ENTRANCE

NUMBER OF EXHIBITS VISITED (<i>n</i> = 100)	ENTRANCE		
	DINOSAUR	MAIN	TOTAL
	EXHIBITS	EXHIBITS	EXHIBITS
Median number of exhibits visited ¹	5	7	6

¹ $\chi^2 = 7.572$; *df* = 1; *p* = .006 (Kruskal-Wallis test)

⁶ On the observation form, 33 exhibits are listed. Of these, three were Orlando Science Center exhibits in the *Giant Worlds* exhibition space, and one was Activity Cart, which was not made available during the observations. These four exhibits were removed from the analysis.

VISITATION TO INDIVIDUAL EXHIBITS

The exhibition included 29 exhibits of various types (see Table 8). Over one-half were interactive in some way ($n=17$). Many interactive exhibits posed a challenge to users while others provided information and content. The exhibition also included standalone wall panels and graphics ($n=8$), video exhibits ($n=3$), and a theater presentation ($n=1$).

TABLE 8
GIANT WORLDS EXHIBIT TYPES

EXHIBIT TYPES	EXHIBITS
Multimedia interactive that poses a challenge to the user (MI/C)	8
Wall panel - Graphic (G)	8
Multimedia interactive that provides information (MI/I)	5
Video (V)	3
Interactive that poses a challenge to the user (I/C)	2
Interactive that poses a challenge to the user plus video (V-I/C)	1
Interactive that provides information (I/I)	1
Theater (T)	1

TIME SPENT AT INDIVIDUAL EXHIBITS

Table 9 (see next page) shows the median time visitors spent at each exhibit. Visitors spent the most time at the theater, watching Giant Worlds Odyssey (median time = 3 minutes, 58 seconds). Also near the top of the list, based on median time, are three multimedia interactive exhibits: Magnetic Attraction (median time = 2 minutes, 52 seconds), Planet Challenge (median time = 2 minutes, 6 seconds), and Gravity Rules (median time = 1 minute, 46 seconds).

Five exhibits have no recorded times because no visitors were observed using them. These include four wall panels (Giant Worlds: Voyage to the Outer Solar System, Meet the Giants, Voyager, Planet Wall: Uranus), and one video (Earth Adventures: Birth of our Solar System).

Of exhibits used, visitors spent the least time at four exhibits: the wall panel Giant Worlds are Giant (median time = 13 seconds), the wall panel Planet Wall: Neptune (median time = 10 seconds), the video Portraits of the Giants (median time = 8 seconds), and the video Cosmic Light Show (median time = 5 seconds).

TABLE 9**TIME SPENT AT INDIVIDUAL EXHIBITS**

EXHIBIT TYPE ¹	EXHIBIT NAME	NUMBER OF VISITORS THAT STOPPED (n = 100)	MEDIAN TIME (MIN:SEC)
T	Giant Worlds Odyssey	19	3:58
MI/C	Magnetic Attraction	42	2:52
MI/C	Planet Challenge	39	2:06
MI/C	Gravity Rules	4	1:46
MI/C	Extreme Seasons	36	1:12
MI/C	Friend or Foe	70	1:07
MI/C	Seeing the Unseen	47	1:07
MI/C	Planet Plunge	26	0:48
MI/I	Planet Wall: Saturn	4	0:38
MI/C	Be an Astronomical Detective	29	0:35
MI/I	Planet Wall: Jupiter	6	0:33
I/C	Secrets of the Bulge	51	0:31
V	Earth Adventures: Crash Course	4	0:28
V-I/C	Moon Dance	47	0:26
MI/I	What's Next: Missions	30	0:25
MI/I	Ring Worlds	22	0:24
I/C	Tools of the Trade	38	0:22
MI/I	Light Probe	35	0:21
I/I	Teamwork: Mission Success	19	0:18
G	Giant Worlds Galore	6	0:17
G	Giant Worlds are Giant	18	0:13
G	Planet Wall: Neptune	2	0:10
V	Portraits of the Giants	7	0:08
V	Cosmic Light Show	5	0:05
G	Giant Worlds: Voyage to the Outer Solar System	0	--
G	Meet the Giants	0	--
G	Voyager	0	--
G	Planet Wall: Uranus	0	--
V	Earth Adventures: Birth of our Solar System	0	--

¹Exhibit types: G=Wall panel or graphic; I/C= Interactive with Challenge; I/I= Interactive with Information; MI/C=Multimedia Interactive with Challenge; MI/I=Multimedia Interactive with Information; OSC=Pre-existing exhibit; T=Theater; V=Video; V-I/C = Video and Interactive with Challenge.

STOPS MADE AT INDIVIDUAL EXHIBITS

More than one-half of visitors stopped at the multimedia interactive exhibit Friend or Foe (70 percent) and the interactive exhibit Secrets of the Bulge (51 percent) (see Table 10, next page). Between one-third and one-half of visitors stopped at the interactive exhibits Seeing the Unseen (47 percent), Moon Dance (47 percent), Magnetic Attraction (42 percent), Planet Challenge (39 percent), Tools of the Trade (38 percent), Extreme Seasons (36 percent) and Light Probe (35 percent).

Exhibits with low usage included Portraits of the Giants (7 percent), the wall panel Planet Wall: Jupiter (6 percent), the wall panel Giant Worlds Galore (6 percent), the video Cosmic Light Show (5 percent), the wall panel Planet Wall: Saturn (4 percent), the video Earth Adventures: Crash Course (4 percent), the multimedia interactive Gravity Rules (4 percent), and the wall panel Planet Wall: Neptune (2 percent).

No observed visitors stopped at four wall panels (Giant Worlds: Voyage to the Outer Solar System, Meet the Giants, Voyager, Planet Wall: Uranus) and one video (Earth Adventures: Birth of our Solar System).

TABLE 10
STOPS MADE AT INDIVIDUAL EXHIBITS

EXHIBIT TYPE¹	EXHIBIT NAME	% OF VISITORS THAT STOPPED (n = 100)
MI/C	Friend or Foe	70
I/C	Secrets of the Bulge	51
MI/C	Seeing the Unseen	47
V-I/C	Moon Dance	47
MI/C	Magnetic Attraction	42
MI/C	Planet Challenge	39
I/C	Tools of the Trade	38
MI/C	Extreme Seasons	36
MI/I	Light Probe	35
MI/I	What's Next: Missions	30
MI/C	Be an Astronomical Detective	29
MI/C	Planet Plunge	26
MI/I	Ring Worlds	22
T	Giant Worlds Odyssey	19
I/I	Teamwork: Mission Success	19
G	Giant Worlds are Giant	18
V	Portraits of the Giants	7
MI/I	Planet Wall: Jupiter	6
G	Giant Worlds Galore	6
V	Cosmic Light Show	5
MI/I	Planet Wall: Saturn	4
V	Earth Adventures: Crash Course	4
MI/C	Gravity Rules	4
G	Planet Wall: Neptune	2
G	Giant Worlds: Voyage to the Outer Solar System	0
G	Meet the Giants	0
G	Voyager	0
G	Planet Wall: Uranus	0
V	Earth Adventures: Birth of our Solar System	0

¹Exhibit types: G=Wall panel or graphic; I/C= Interactive with Challenge; I/I= Interactive with Information; MI/C=Multimedia Interactive with Challenge; MI/I=Multimedia Interactive with Information; OSC=Pre-existing exhibit; T=Theater; V=Video; V-I/C = Video and Interactive with Challenge.

FACTORS ASSOCIATED WITH INDIVIDUAL EXHIBIT STOPS

Stops at individual exhibits (visited by at least 20 observed visitors) were compared by gender, age group, visit day, level of crowding, and visit group size. There was one significant finding associated with one exhibit.

- ◆ Males were more likely to stop at Magnetic Attraction (51 percent) than were females (30 percent) (see Table 11).

TABLE 11
STOPPED AT MAGNETIC ATTRACTION EXHIBIT BY GENDER

STOPPED AT MAGNETIC ATTRACTION	GENDER		
	MALE (n = 57)	FEMALE (n = 43)	TOTAL (n=100)
	%	%	%
No	49	70	58
Yes	51	30	42

$\chi^2 = 4.288; df = 1; p = .043$

VISITOR BEHAVIORS

This section describes how visitors experienced exhibits in the exhibition, focusing on visitors' interaction behaviors at exhibits as well as visitors' misuse of exhibit components.

INTERACTIONS WITH OTHERS AT EXHIBITS

Data collectors noted whether the observed visitor interacted with anyone while using an exhibit. If there was interaction, the observer recorded whether it occurred with an adult, child, or OSC staff member. Overall, most visitors (99 percent) interacted with others, and most visitors interacted with others at multiple exhibits (see Table 12).

TABLE 12
NUMBER OF EXHIBITS AT WHICH VISITORS INTERACTED

NUMBER OF EXHIBITS AT WHICH VISITORS INTERACTED	% OF VISITORS THAT INTERACTED
0	1
1 – 3	36
4 – 6	30
7 – 9	24
10 or more	9

Appendix D gives detailed information on visitors' interaction at all exhibits. Table 13 lists exhibits with high interaction percentages (interaction by greater than 70 percent of observed visitors).

Of Giant Worlds exhibits, the interaction percentages are high for Seeing the Unseen (89 percent), Planet Challenge (74 percent), Magnetic Attraction (71 percent) and Tools of the Trade (71 percent). While all visitors who stopped at Gravity Rules interacted with someone (100 percent), only four visitors stopped at this exhibit.

TABLE 13
EXHIBITS WITH HIGH VISITOR INTERACTION

EXHIBIT TYPE ¹	EXHIBIT NAME	NUMBER OF VISITORS THAT STOPPED (n = 100)	NUMBER OF VISITORS THAT INTERACTED	% OF VISITORS THAT INTERACTED
MI/C	Gravity Rules	4	4	100
MI/C	Seeing the Unseen	47	42	89
MI/C	Planet Challenge	39	29	74
MI/C	Magnetic Attraction	42	30	71
I/C	Tools of the Trade	38	27	71

¹Exhibit types: I/C= Interactive with Challenge; MI/C=Multimedia Interactive with Challenge; OSC=Pre-existing exhibit..

INTERACTIONS WITH STAFF

Data collectors noted whether observed visitors interacted with staff as they visited the exhibition (see Table 14). A total of 17 observed visitors interacted with staff, but not at any particular exhibit in the exhibition.

TABLE 14
INTERACTIONS WITH STAFF

STAFF INTERACTIONS (n = 100)	%
Interaction with staff not associated with an exhibit	17

USE AND MISUSE OF INTERACTIVE COMPONENTS

Data collectors recorded instances when observed visitors stopped at an interactive exhibit but did not use the interactive component, or else used it incorrectly. Appendix D gives detailed information on visitor use/misuse at all interactive exhibits. For the most part, visitors at an exhibit rarely skipped the interactive component and less than half of visitors (46 percent) misused the interactive components (see Table 15).

TABLE 15
NUMBER OF EXHIBITS MISUSED BY VISITOR

NUMBER OF EXHIBITS MISUSED	PERCENTAGE OF VISITORS THAT MISUSED EXHIBITS %
0	54
1	21
2	21
3 or more	4

PRINCIPAL FINDINGS: INTERVIEWS

RK&A conducted 31 onsite interviews in June 2008 with visitors between the ages of 8 and 13 as they exited *Giant Worlds*. Of the interviewees, 17 were male and 14 were female; interviewees' median age was 10. All but three interviewees had been to the Orlando Science Center before. A total of 40 visitors were invited to participate in the evaluation but eight declined, for a refusal rate of 20 percent.⁷

OVERALL OPINION OF THE EXHIBITION

One-half of interviewees said that they liked the exhibition, and most of them described it as “cool” or “awesome.” Some⁸ other interviewees said the exhibition was educational, and a few of these interviewees mentioned specific information learned (see the first quotation below). Some said the exhibition was fun, and a few said it was interesting.

In the exhibit *Giants Worlds*, it can teach lots of interesting things about the different planets, and it can also teach you things that you didn't know, like [about] the gravity of Saturn's ring system. [male, 9]

FAVORITE ACTIVITIES

When asked what activity they liked most, many interviewees named or described a specific exhibit. Approximately one-third liked Planet Challenge⁹, and some liked Magnetic Attractions and Seeing the Unseen. Idiosyncratic responses included Friend or Foe, Odyssey Theater, Giant Worlds are Giant, Tools of the Trade, Extreme Seasons, and Moon Dance. One-quarter of interviewees said they liked all the exhibits.

When asked to consider why they liked the activities they did, approximately one-third of interviewees said they liked activities in which they learned something (see the first quotation below) or were shown something (see the second quotation). Approximately another one-third of interviewees did not have an answer. Some interviewees explained that they liked challenging activities (see the third and fourth quotations).

[Regarding Odyssey Theater,] it told you a lot of facts about the planets and the moons with them, so it included everything about the planets. [male, 13]

[Regarding Seeing the Unseen,] I like how it showed you how different parts of your body are hot and the cold parts. [male, 11]

[Regarding Friend or Foe,] I liked that [it] was challenging; it took a couple tries. [male, 12]

[Regarding Planet Challenge,] I liked that you got to push the buttons and then it gave a question. [female, 13]

⁷ The number of participants (31) plus the number of visitors that declined (8) does not equal the number of visitors invited to participate in the study (40) because one interview was conducted although it was inaudible, and thus not part of the study.

⁸ The following language is used to describe the number of responses: one (1), a couple (2), a few (3-6), some (7-16), many (17-26), and most (27-32).

⁹ Most interviewees did not call the exhibits by name, but rather by description. The exact name of the exhibit has been used, however, to facilitate reporting and analysis.

LEAST FAVORITE ACTIVITIES

When asked whether any exhibits were less interesting, one-third of interviewees said none. Some interviewees named specific exhibits, the majority of which were referenced by other interviewees as most favorite exhibits. Of the exhibits named, Tools of the Trade was mentioned twice and Extreme Seasons, Friend or Foe, Magnetic Attractions, and Planet Plunge were each mentioned once. A few interviewees said they did not know which activity was less interesting, and a few said they did not like certain types of exhibits, such as those with computers, text, and interactives.

Only a few interviewees explained why an activity was less interesting, and of these, the majority mentioned something about interactives. One interviewee said there were not enough interactives (see the first quotation below), and another said that the interactive did not provide enough challenges (see the second quotation).

[Regarding Tools of the Trade,] I didn't like it because it didn't have much stuff to interact with. [male, 9]

Probably the magnetic field pinball thing [Magnetic Attractions], because it only had, like, three or four parts to it, and it didn't continue after that. It just stopped. [male, 12]

Interviewees were also asked whether any exhibits were boring or hard to understand. Approximately two-thirds of interviewees responded no, but some interviewees named specific exhibits, including Odyssey Theater, Tools of the Trade, Magnetic Attractions, Friend or Foe, and Extreme Seasons, which were each mentioned once.

Again, only a few interviewees could explain why certain exhibits were boring or hard to understand, and most of these explanations had to do with the information presented. For example, a couple interviewees did not understand certain information presented (see the first quotation below). Another said the knowledge presented was not new, therefore, the exhibit was boring (see the second quotation).

The big theater [be]cause I don't know what they're saying. [female, 11]

[Regarding Extreme Seasons,] because I already know what Northern and Southern hemispheres, and summer and winter are. It's so easy to do. [male, 9]

INTERACTION WITH STAFF

Slightly more than one-half of interviewees said they did not interact with staff in the exhibition, and slightly less than one-half of visitors said they had contact with staff. Of those that said they interacted with staff, some interacted with staff at exhibits not related to *Giant Worlds*, and a few did not specify the nature of the interaction; only a few interviewees cited interactions specific to the exhibition, naming the exhibits Friend or Foe and Planet Challenge. Most interviewees that cited interaction with staff did not give their opinion of the interaction, and a few made vague, but positive remarks about the interaction.

COMPREHENSION

EXHIBITION'S OBJECTIVE

When asked what they thought the exhibition was trying to teach kids, many interviewees generally said the exhibition was about planets, space, the Solar System, or the Universe (see the first quotation below). Of these interviewees, a few mentioned that the exhibition's objective was to teach kids about how other planets affect life on Earth (see the second quotation) while a couple others mentioned that it was about planets other than Earth (see the third quotation). A few responded that they did not know; a couple interviewees each said the exhibition was about science or new things, and a couple others mentioned things not related to the exhibition.

About our Solar System and the planets and all about them, I think. [female, 13]

It's trying to teach kids more about the Universe and how it affects our lives. [male, 13]

It's trying to teach kids about other planets besides Earth and outer space. [female, 8]

GIANT PLANETS

Many interviewees recalled something they learned about giant planets from the exhibition. Of these, the majority remembered learning about the size of the giant planets (see the first quotation below) and that the giant planets are gaseous (see the second quotation). Other recollections included information about the giant planets' moons and relative location in space (see the third quotation). Some did not respond, and a few said they learned nothing about giant planets.

How small is Earth and how big are the other planets. [male, 10]

Like Jupiter, it is a gas planet and it's very big, and it's millions of times bigger than the Earth. [female, 11]

Like how big they [giant planets] were and how far they were from the Sun. [male, 10]

Most interviewees could not name a specific exhibit from which they learned a particular fact about giant planets. A few could not recall a specific exhibit although they generally cited computer exhibits or movies. Three interviewees said they learned about giant planets from Planet Plunge (see the first quotation below), and one interviewee each referenced Friend or Foe or Planet Challenge (see the second quotation below).

That they, [giant planets], are all gaseous planets and you can't land on them. (Can you give me an example from the exhibition that showed you that?) Probably some of the display boards where they talked about it mostly, and one of the things [where] we could turn a little crank and it talks about it, trying to show how it, like, lands, or whatever. [male, 12]

Some of them [giant planets] are bigger and if you land on a bigger planet, you could be crushed and destroyed. (Could you give me an example from the exhibition that showed you that?) Yeah. In the trivia, if you land on a planet with, like, a large amount . . . of mass and stuff, you could easily be crushed by the gravity. [female, 10]

EFFECT OF GIANT PLANETS ON EARTH

Some interviewees said the exhibition did not affect the way they think about Earth. Some others said it did, and gave specific examples. A few of these interviewees gained perspective about the Earth's size (see the first quotation below). A couple interviewees each mentioned that they learned about oxygen being unique to Earth or that giant planets affected Earth's physical characteristics (see the second quotation). A few responded with vague or unrelated statements, and a couple did not recall anything about Earth (see the third quotation).

It kind of makes me think that Earth is small compared to most of the gas planets. [female, 11]

On the Friend or Foe one, if a giant gaseous planet is too close to the Sun, it can cause disastrous results to Earth. [male, 9]

There wasn't actually that much about Earth, mostly the other planets. [male, 11]

When asked to recall a specific exhibit that affected their view of Earth, most could not recall one. The two interviewees who recalled a specific exhibit mentioned Friend or Foe and Giant Worlds are Giant.

SCIENTISTS' KNOWLEDGE

When asked how scientists know what they know about the giant planets, less than one-half of interviewees mentioned specific instruments such as satellites, telescopes, and probes (see the first quotation below). Some interviewees said that scientists go to space, and some did not know how to respond. A few interviewees said that scientists learn from research and a few said that they learn from pictures. A couple answers were idiosyncratic.

They use shuttles and they use satellites. [male, 11]

Only a few interviewees named an exhibit that explained how scientists know about space, and the exhibits mentioned were Tools of the Trade (see the first quotation below) and Planet Challenge. A few said there was not an exhibit that explained how scientists learn about the giant planets. Other answers were idiosyncratic.

The first part [Tools of the Trade], with the telescope where it says who invented the telescope and how he looked at the planets. [male, 10]

FEELINGS AND CURIOSITIES

FELT LIKE A SCIENTIST OR EXPLORER

Many interviewees said they felt like a scientist or explorer in the exhibition although only some interviewees could name a specific exhibit where they felt this way. Those who mentioned a specific exhibit named Tools of the Trade (see the first quotation below), Planet Challenge, and Light Probe. A few said they felt like a scientist or explorer but mentioned feeling so at exhibits unrelated to the exhibition, and a few interviewees said they felt like a scientist or explorer because they were learning new things (see the second quotation).

I felt like on the star one, the Tools of the Trade, I felt like I was looking at the stars, and seeing some of them are really far. [female, 9]

I was learning a lot, and I was finding out things, some of them I didn't really know. You don't really get to do that every day. [male, 12]

CURIOSITIES

When asked whether they left with any questions and curiosities, many interviewees responded negatively. Of those who responded affirmatively, a couple wondered about the moons, and a couple wondered generally about the planets and stars (see the first quotation below). One interviewee wondered what it is like in space (see the second quotation), and another wondered whether anyone had actually been to a galaxy shown in the exhibition (see the third quotation).

I wondered how many stars and how many worlds there are and so, you know. [female, 9]

Yeah, I wondered what it's actually like in space and I haven't traveled there before. [female, 10]

The one where it shows the galaxy—I was wondering if anybody has been actually out of that galaxy and how they found out how they [galaxies] got so big. [male, 9]

APPENDICES

REMOVED FOR PROPRIETARY PURPOSES