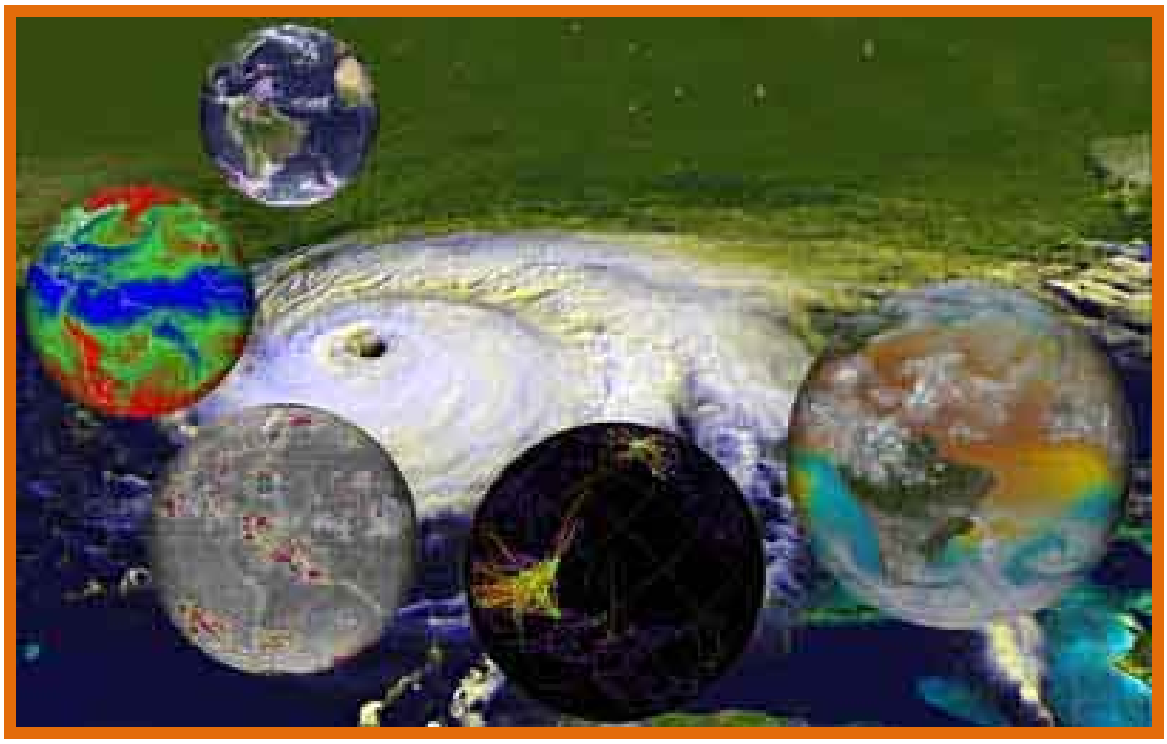
Science on a Sphere®:

An Evaluation of an Educational Display



conducted at the

Amazonia Science Gallery
National Zoological Park

Smithsonian Institution

Office of Policy and Analysis

February 2010

Preface

The Office of Policy and Analysis (OP&A) was pleased to conduct a baseline study and two follow-up studies in the Amazonia Exhibit's Science Gallery, specifically of the globes' role in the room. The goal of the studies was to understand visitors' experiences in the Science Gallery and their interaction with the geosphere in 2008 and one year later with the *Science on a Sphere*® (SOS) installation.

The National Zoological Park (NZP) provided excellent guidance to the study team. In particular, I would like to thank Miles Roberts, Wildlife Biologist and Curator of the Amazonia Science Gallery, who initiated the study and helped at every step of the process. As he leaves the NZP, we wish him all the best during retirement. I would also like to thank Kairo Vivas, the former Amazonian Science Gallery Coordinator, and Katherine Dennis for their assistance in facilitating the interviewing. It was a pleasure working with them.

Visitors' willing participation in these studies was very gratifying. The time they provided is evidence of their interest in improving the overall visitor experience at the Smithsonian.

Within OP&A, staff members, Zahava D. Doering, Andrew Pekarik, and research associate Heather Mauger were responsible for designing and analyzing the questionnaires. Interns Sarah Block, Will Hix, Givi Khidesheli, Annie Lefebure, Sherry Martin, Kristin Rector and Ikuko Uetani administered the survey, conducted interviews and prepared the data sets. Ikuko Uetani assisted with report review and preparation. I thank everyone for his or her hard work and dedication.

Carole M. P. Neves
Director, Office of Policy and Analysis

Table of Contents

Photo Credits: All photos from *Science on a Sphere*® Dataset Catalogue, http://sos.noaa.gov/datasets/, accessed 21 April 2010.

Executive Summary

The Study

The Purpose: These studies were conducted as part of an evaluation of the *Science on a Sphere*® (SOS) visualization installation in the Amazonia Science Gallery (ASG) of the Amazonia Exhibit at the National Zoological Park (NZP). The goal was to identify the impact of the SOS installation on the experience of ASG, to help the staff plan future programs for presentation on the new SOS, and to gauge visitors' reactions, comments, and knowledge about the globe.

The Design: In 2008, i.e., before the SOS was installed but while a static globe (the geosphere) was in place at ASG, data were collected by means of both personal interviews and a sample survey. After installation of SOS in 2009, data were collected by similar means in three different contexts. In the first, Baseline, the globe cycled automatically through a series of ten visualizations on different topics. Identification labels were not present and staff was not stationed at the SOS to explain visualizations to visitors. In the second context, Descriptions, identification labels were added to the visualizations. Finally, in the third context, Staff, staff was present to answer questions and/or present explanations of the visualizations.

The Surveys: In both 2008 and 2009 the surveys were administered using identical procedures. An interviewer-administered questionnaire was directed to a systematically selected sample of individuals over the age of 12. Eligible visitors were asked to participate in the study upon exiting the Amazonia Science Gallery Amazonia Exhibit. One survey was conducted in 2008 and three in 2009. Altogether, interviewers approached 636 eligible visitors, and 574 completed the interviews for a cooperation rate of 90 percent. In all the surveys, visitors were asked to rate their overall experience of ASG, as well as to describe their activities in the Amazonia Science Gallery. In all three post-SOS-installation surveys, visitors were also shown a set of cards from the visualizations, and asked to identify and describe the ones they saw.

Major Findings

Visitors: The majority of respondents (73% in 2008 and 67% in 2009) were visiting the Amazonia Exhibit for the first time. Among repeat visitors to the Amazonia Exhibit, a similar percentage (61%) had previously visited the Amazonia Science Gallery. Nearly all (96%) visited the National Zoo with others, generally in groups of three or more people.

Rating: Visitors were asked to rate their overall experience in the Amazonia Science Gallery. There were no significant differences across all three post-SOS-installation surveys in 2009. The combined rating of visitors exiting (Poor 0%, Fair 3%, Good 23%, Excellent 56%, and Superior 18%) was about the same as for other Smithsonian exhibits that have been evaluated over the last six years. The experience ratings in 2009 also did not differ from those in the 2008 Pre-SOS survey.

Activities: Visitors noted an average of 2.6 activities in which they participated while in the Amazonia Exhibit (including ASG). The major activities mentioned were looking at the live animal

displays, followed by looking at the SOS. Statistical analysis did not identify any patterns in activity involvement across the three SOS situations. For example, more visitors reported seeing the SOS in the Baseline SOS survey, compared to the other two SOS surveys; more visitors reported using the microscopes in the Descriptions survey, compared to the others. But when asked to select the single most interesting activity, no differences were found across the three SOS surveys. Across all the 2009 surveys about one-fourth of the respondents named the SOS as the most interesting display followed by live animal displays.

Attention to Visualizations: Interviewees identified an average of 2.2 visualizations from the set of representative images they were shown after leaving ASG. Several (*Sea Currents, Red Mars,* and *Earth at Night*) were identified more frequently when staff was present. There were no statistical differences in the error rates (i.e., rate of incorrect identification) across the three SOS surveys for 7 of the 10 visualization photos. Where there were differences, they do not seem to be related to differences in the context.

Discussion

This study, conducted before SOS was installed and again in the early phases following the installation of a *Science on a Sphere*® at the National Zoological Park, shows that visitors to the Amazonia Science Gallery were enjoying their exposure and gaining some understanding from the SOS. However, the results indicate that major changes will need to be made in order to realize the potential of SOS in the zoo environment. The results of this study suggest a number of possible improvements that could be tested relatively easily. A number of these ideas have been suggested to NOAA in a recent document supporting a no-cost extension to the grant. Among these are:

- Conduct an additional series of evaluations that will address questions about suitability of content and the effectiveness of different SOS presentation techniques to diverse target audiences.
- Organize and host a one-day workshop/meeting of the SOS institutions in the local region (Maryland Science Center; Goddard Space Flight Center; National Museum of Natural History; Nautica in Norfolk, VA; NZP) to get together, share ideas on what works and what doesn't and develop collaborations. Such meetings could take place among regional SOS facilities once or twice a year on a rotating basis. NZP staff could visit institutions that are leaders in SOS innovation to learn about the most current techniques and technologies in use for presentations, content development, and possible collaborations.
- Produce new content based on Smithsonian and NZP science activities that can be field tested with visitors as it is being developed to determine how best to use SOS to communicate science content to zoo visitors in the zoo exhibit context.

Background

The setting

The Amazonia Exhibit is a 15,000-square-foot facility at the National Zoological Park (NZP) that features two main areas. The first is a tropical rainforest, located in a greenhouse, complete with animals native to the Amazon. The second area is the Amazonia Science Gallery, a hands-on science center with interactive exhibits. Visitors explore the exhibition in a linear, one-way manner, entering at the rainforest and exiting through the Amazonia Science Gallery. While the two parts of the Amazonia Exhibit are contiguous, visitors can exit after the rainforest exhibit without visiting the Amazonia Science Gallery.

The Amazonia Science Gallery occupies 8,000 square feet and houses four scientific laboratories that are visible to the visitors. Visitors can read books and magazines, watch videos, and work with artifacts, materials, and computer interactives that relate to Smithsonian and NZP scientists' work. Until Fall 2008 the center of the room was occupied by a geosphere, a 6-foot-diameter, high-resolution globe that rotated on its axis. Three nearby multimedia interactive stations presented interpretive material related to geography and study and conservation of biodiversity. In addition there were continuous video loops on television monitors that enhanced visitors' experiences with the globe. Just below the globe, as a part of the supporting table, was a video screen sequentially depicting earthquakes and volcanic eruptions around the world over the last sixty years, thus identifying the boundaries of the tectonic plates of the earth's crust.

Science Gallery Globe 2008

In February 2009, the National Oceanic and Atmospheric Association (NOAA), in partnership with the NZP Amazonia Exhibit, installed a new globe called *Science on a Sphere*® (SOS) [1] in the Amazonia Science Gallery. This new technology uses computers and LCD projectors to present animated visualizations and videos about global and planetary processes to be shown on a spherical display system. As NOAA describes it on its web site, "SOS is an animated globe that can show dynamic images of the atmosphere, oceans, and land of a planet. NOAA primarily uses it as an education and outreach tool to describe the environmental processes of earth."[2]

Methodology

The Office of Policy and Analysis (OP&A) conducted a two-part study related to the SOS. In the summer of 2008, a Pre-SOS study of the effectiveness of the existing geosphere and the experiences of visitors prior to the installation of SOS was conducted. The 2008 study was also designed to help the staff select programs for presentation on the new SOS, since interviewees were asked to give their top three thematic choices from a list of possible subjects. OP&A conducted personal interviews to gauge visitors' thoughts, comments, and knowledge about the globe and global processes and to highlight common misconceptions that the SOS could potentially address. OP&A also fielded a sample survey to collect quantitative data. The 2008 questionnaire is in Appendix A.[3]

In the summer of 2009, between July 21 and August 7, after the SOS was installed, OP&A conducted three similar sample surveys. In the first, Baseline, the globe cycled automatically through a series of ten visualizations on different topics. Labels were not present and staff was not stationed at the SOS to explain visualizations to visitors. In the second situation, Descriptions, identification labels were added to the visualizations. Finally, in the third situation, Staff, staff was present to answer questions and/or present explanations of the visualizations.

Data for all four surveys, i.e., both in 2008 and 2009, were collected in an identical manner. The surveys were conducted with visitors who visited the entire Amazonia Exhibit and exited after passing through the Amazonia Science Gallery. Two interviewers and a designated counter stood outside of the Amazonia Science Gallery. The counter tallied the total number of visitors who exited, not including large school groups or children under the age of 12. Once an interviewer was ready, the counter identified the next interviewee whom the interviewer should intercept. The 2009 questionnaire is in Appendix A.

If the intercepted person refused to participate, the interviewer asked for his or her zip code and marked the questionnaire as a refusal. If the intercepted person did not speak English, and did not have a translator present, the questionnaire was marked as ineligible. If the intercepted person was under the age of 12, the questionnaire was also deemed as ineligible. During the four surveys (i.e., one in 2008 and three in 2009), the interviewers approached 636 visitors eligible for the surveys, and 574 completed the interviews, for a cooperation rate of 90 percent. (The detailed results of the fieldwork are the last page of Appendix A).

[1] For more information, visit NOAA's website: http://sos.noaa.gov/
[2] *Op. cit.*
[3] A complete report of the 2008 study is in Office of Policy and Analysis. 2008. *Plan-it for the People*. Available at http://www.si.edu/opanda/sov_exhibitions.html

In the course of all the surveys, interviewees were shown a card with five possible ratings (Poor, Fair, Good, Excellent, Superior) and were asked, "*How would you rate your overall experience in the Science Gallery today*?" The card included the letters A through E, which corresponded to the five ratings. The letters were used to make the respondent more comfortable in giving the Amazonia Science Gallery a low rating (See Appendix B). Then they were asked to describe their activities. Interviewers were familiar with the Amazonia Science Gallery, so they could code the responses into pre-determined categories, even if the description was not precise. [4]

In the post-SOS surveys, respondents were also shown a set of 10 cards representing the ten visualizations that were automatically cycled on the SOS, asked which ones they saw and, for each card they selected, were asked to say something about what it showed. (The full set of cards is in Appendix B.)

The population for this study is not entirely comprehensive. No interviews were conducted with children under the age of 12 even though they are one of the main target audiences for the SOS display. The study did not cover those who left the Amazonia Exhibit before reaching the Amazonia Science Gallery and, thus, did not ask those who left early why they did not continue downstairs.

The next section of the report briefly describes the interviewees. This is followed by a presentation of the 2009 results and comparisons to 2008, where appropriate. The last section is a discussion of the results.

Science Gallery Globe 2009

[4] At the time the study was conducted an Amphibian Display was also installed in the Amazonia Science Gallery (ASG). Beginning on July 28, 2009 when ASG staff felt that major portions of the Amphibian Display were installed, exiting visitors were also asked to rate the Amphibian Display, using the same scale that was used to rate the overall Science Gallery. The 2009 questionnaire is in Appendix A.

Amazonia Science Gallery Exit Survey: Findings

Demographics/Characteristics of Visitors[5]

For the majority of 2008 respondents (73%) the day of interview was their first visit to the Amazonia Exhibit. However, those who had been to the exhibit before the day of the interview had visited it on average 4.3 times previously. Those who had previously visited the Amazonia Exhibit were asked "*Have you spent time in the Science Gallery before today?"* [6] and 60% responded that they had. This means that while 27% of all visitors had been to the Amazonia Exhibit before the interview, only 16% of all visitors had previously spent time in the Amazonia Science Gallery (ASG).

In 2009, the number of first-time visitors to the Amazonia Exhibit was somewhat lower (67%). Those who had been to the building before had visited it on average 5.3 times before. In 2009, while about one-third (33%) had been to the Amazonia Exhibit, only one-fifth (20%) had been to the ASG.

A large percentage of the visitors (92% in 2008 and 95% in 2009) were from the United States with one-fourth (25%) in 2009 and fewer (19%) in 2008 from the Washington Metropolitan area; in both years 37% of visitors lived within 40 miles of the National Mall. Most people (96% in both years) came with others. Women were a clear majority of the visitors in 2008 (61%) but only a slight majority in 2009 (53%). The average age of the interviewees was 37 in 2008 and somewhat younger, 35, in 2009. Examination of the detailed data showed more visitors below age 20 in 2009.[7]

In sum, with a few differences, the visitorship across the two years and the four surveys can be said to be similar.

Rating

As noted earlier, during the interview interviewees were shown a card with possible ratings and were asked, "*How would you rate your overall experience in the Science Gallery today*?" The scale, shown on the card, is Poor (A), Fair (B), Good (C), Excellent (D) and Superior (E). This scale has been used by OP&A throughout the Smithsonian for more than 50 exhibitions over the past six years. OP&A analyses indicate that those who are critical of exhibitions, to some degree, choose Good, Fair, or Poor. Excellent is a rating that indicates that the visitor is very satisfied and has no particular criticisms. Those who feel that the exhibition is so special that Excellent is not adequate as a rating select the Superior rating. The rating results are skewed towards the high end, thus, Excellent is the average.

[5] For detailed data, see Appendix C
[6] For a sample questionnaire, see Appendix A
[7] The average age does not include members of organized school groups, or children under 12.

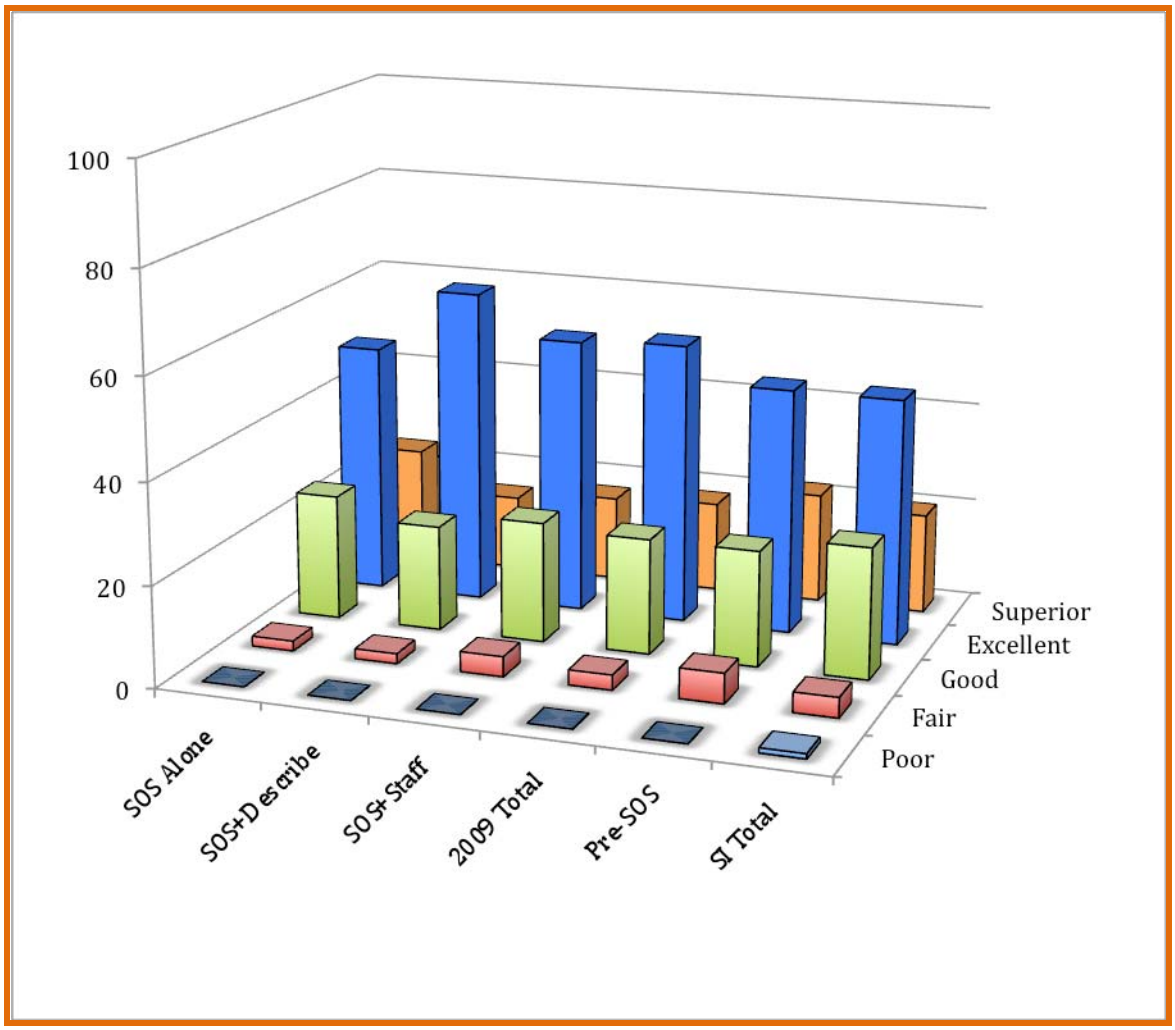


Figure 1. Rating of Overall Experience in Amazonia Science Gallery

As shown in the figure, the differences across the three SOS surveys are minor and do not differ from the Pre-SOS results. The 2009 Total ratings are (from Poor to Superior) 0%, 3%, 23%, 56% and 18%, In the Pre-SOS survey the comparable figures were 0%, 6%, 23%, 49% and 22%. These results are in line with the average OP&A ratings across museums and exhibitions (1%, 4%, 26%, 49% and 20%). (Appendix C contains frequencies for this study.)

Activities

Both in 2008 and 2009, visitors were asked what they did in the Amazonia Science Gallery. In 2008, responses were recorded within 19 pre-coded activity categories; in 2009 a few more categories, specifically related to the new Amphibian Extinctions exhibit, were added. On average, visitors reported participating in 2.6 activities in both years. It is likely that visitors under-reported their activities, because interviews were conducted directly outside of the Amazonia Science Gallery. Interviewers used only general probes, and not a list; as a result it is possible that visitors named what they remembered doing or what was most interesting to them. Interestingly, more visitors spontaneously reported that they saw the SOS during the first SOS survey, the one without captions and without an explanation or presenter.

The five most frequently noted 2008 activities are listed in the first column, and their frequencies in 2009 are shown in the second column:

Reported Activities	2008%	2009%
Live Animal Displays	69	65+43*
Microscope Displays	42	29
Bones	24	19
Computer Interactive Station	23	4
Globe (geosphere in 2008 and SOS in 2009)	22	56

*In 2008 a distinction was not made between live animals in the rainforest and in the ASG. In 2009, the 65% refers to the ASG and the 43% to the rainforest.

As a follow-up, visitors were asked to name the one activity that was most interesting to them. In 2008, Live Animal Displays was the most interesting for 41% of the visitors. Seventeen percent of people thought that the Microscope Displays was most interesting. The Globe, which 22% of visitors reported as an activity, was ranked most interesting by only 6%.

In 2009, OP&A found a different picture. While Live Animal Displays (30% in the ASG and 25% in the rainforest) are still in the lead, 25% name the Globe, and Microscope displays decreased to 10%. The second column in the table above shows that half of the visitors interacted with the Globe (56%) and it was the most interesting activity for the half who did.

In both years, visitors were asked if they noticed the globe and whether or not they interacted with it. About 85% reported noticing the globe in all of the surveys (geosphere or SOS). In 2008, 27% talked about the globe within their group (i.e., among those visiting with others). In 2009, with SOS, that percentage increased to 36%.

Three activities were significantly associated with higher ratings in 2009: Bones (29% Superior), Microscopes (24% Superior), and Talking about the globe in one's group (25% Superior).[8]

Attention to Visualizations

Appendix B contains the ten images shown to interviewees who indicated that they interacted with the SOS – or at least looked at it briefly. As Figure 2 shows, between 13% and 28% selected each of the images after being asked, "Today, which of these images did you see?"

Interviewees were asked to give a description of the images they selected. The study team had expected the percentage that selected each image to increase across the diverse situations (i.e., it was assumed that providing more access to information first with descriptions then with live interpreters would cause visitors to spend a longer time at the globe and thus increase the percentage of any particular image). We expected the unlabeled SOS (Baseline situation) to generate the lowest percentage of images recognized, followed by the situation with descriptions and then the situation in which staff was present. Instead, while more images were identified when staff was present (average of 2.5), a nearly equal number was identified in the Baseline, when neither a staff member

[8] In the Baseline survey, where there were many fewer cases (162 vs. 412), none of the activities were significantly associated with ratings.

nor descriptions were present (average of 2.2). The situation with Descriptions presented the lowest (average of 1.7). Several visualizations (*Sea Currents, Red Mars, and Earth at Night*) were identified more frequently when a staff member was present.

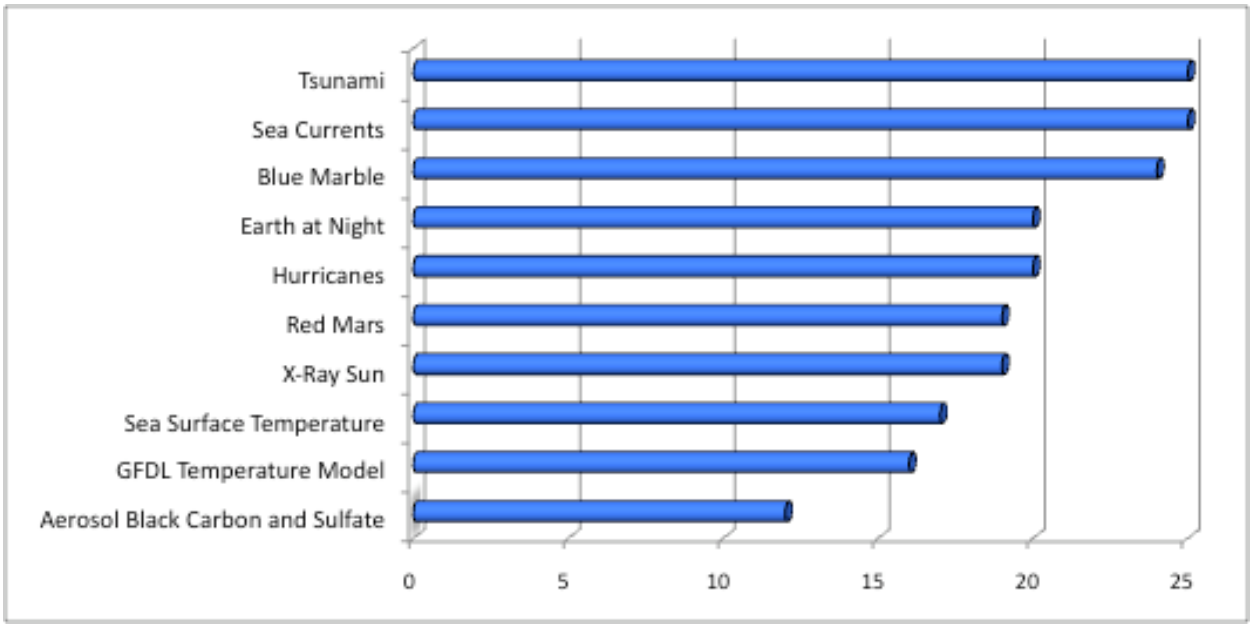


Figure 2. Percent of Interviewees Identifying Image Cards (Across Conditions)

After selecting the images that they saw, interviewees were asked "For each one that you saw, can you say something about what they show? These descriptions were coded for accuracy by OP&A staff. The results show that although adding descriptions and staff did not increase the number of images identified, it did help in improving the accuracy of the narrative about the images slightly. In the Baseline SOS survey, 43% of the descriptions were incorrect. In the Descriptions survey this percentage dropped to 28%. It rose slightly again to 35% in the Staff survey, when a staff member was present. However, these differences were only statistically significant for three of the visualizations and in the aggregate. There were no statistical differences in the error rates (i.e., percentage of incorrect identifications) across the three situations (i.e., Baseline, Descriptions, and Staff) in seven of the ten visualization photos.

What visitors said about SOS[9]

Visitors were given two additional opportunities to make comments related to the SOS. In all three SOS surveys, those who acknowledged talking about SOS in their group were asked what they talked about. The majority did not indicate any discussion about it. The themes of the discussions from comments visitors made are summarized below.

Of those who indicated that they discussed the globe, about one fifth did not provide substantive information but rather offered complimentary descriptions of the exhibit such as 'cool' and 'neat'.

[9] Data on file, OP&A.

Another theme in the responses was natural disasters, especially tsunamis and hurricanes, with several citing specific disasters such as Katrina or the Christmas Tsunami.

The mechanics and physical characteristics of the SOS visualization system was a slightly less prevalent topic of discussion with about eighteen percent of visitors who talked about the globe in their group discussing how it was made and so on. The solar system and Earth were also discussed about ten percent of the time. The rest of the discussions can be aggregated under the general categories of global warming/temperature, weather, geography, logistics and currents (in descending order). The small frequency of their occurrence and the broad scope of these categories make them largely irrelevant statistically.

As information and interpretation was added, the requests for greater explanation and clarity decreased and the suggestions of greater interaction increased. In all three SOS surveys, those who indicated that they had seen the globe were asked for suggestions for improvement. Under Baseline, the leading suggestion after "no improvement needed" was for greater clarity and explanation. A number of respondents were confused by the exhibit and expressed their confusion. This confusion seemed to lessen with each succeeding situation. Fewer suggested more explanation after the addition of explanatory labels and almost none when live interpretation was provided. In terms of providing greater clarity, the addition of a staff member seemed to have made the difference. After "increased interactivity", the most frequent suggestions were for more content. Currents, global warming, and the solar system were often suggested as content additions to the SOS.

Other common suggestions and complaints dealt with more mechanical issues such as the size of the text or the speed of the rotation. At times, these suggestions often ran contrary to each other with one respondent claiming it was too fast, for example, while another claimed it was too slow in the same situation. The most common complaint was the size of the text. A couple of individuals suggested auto-run features or a playlist to help make the globe easier to use.

The request for audio in the form of a narrator or staff speaker decreased across the three situations. Under the Staff condition a few comments were made pertaining to the conduct of the speaker rather than the exhibit as a whole. These few individuals commented that the speaker focused on individuals or families rather than groups and a few were unaware that the staff member was there to answer questions.

Discussion

When the Amazonia Science Gallery team first asked OP&A to assess the forthcoming *Science on a Sphere*® (SOS*)* installation, the study team designed a straightforward before and after study (2008 vs. 2009) to determine the degree to which the addition of the SOS in place of the static geosphere would affect the overall experience of ASG. This study design is very different from those used by other evaluators in studying SOS installations elsewhere. Most installations treat the SOS as an exhibition or display of its own, isolated from its surroundings to some degree, and evaluations of those installations treat the SOS as a free-standing exhibition. And in no other case has the SOS replaced a comparably large static geosphere. The aim of the OP&A design was to determine how the SOS installation would change the overall experience in the Amazonia Science Gallery. It was

felt that this would give a more meaningful measure of the effect of this vivid, dynamic, technologically advanced globe.

The result was unexpected. The difference in the overall ratings that visitors gave their experience in the Amazonia Science Gallery in 2008 with the geosphere and the ratings in the Baseline SOS survey in 2009 (i.e. without descriptions or staff interpreters) was not statistically significant. The addition of labels to the visualizations, and then the presence of staff interpreters at the SOS did not alter the ratings significantly either.

Nonetheless the installation of SOS did change the behavior of visitors in the ASG. Now many more visitors reported the globe as an activity they engaged (from 22% to 56%), and the percentage that found the globe to be the most interesting of those activities increased from 6% to 25%. At the same time 19% fewer visitors used computers (most of which were part of the geosphere display) and 13% fewer visitors used microscopes. This suggests that the SOS drew more attention and more favorable attention.

Why then, did SOS not lead to an increase in visitor ratings of the space? This question obliges us to think more deeply about what makes a visit satisfying for visitors. One possible explanation is that the visualizations on the SOS did not relate directly enough to the interests of these visitors. The SOS is installed in an exhibit that is primarily focused on live animals. Visitors to the SOS in Amazonia Science Gallery have intense, immersive experiences in the rainforest exhibit, then immediately encounter a prominent exhibition of exotic frogs in a space immediately adjacent to the SOS.[10] The drawing power of the live animals (and their competition for visitors' attention) is quite clear in the data.

In addition, SOS in this gallery is one option among many. In view of the size and prominence of SOS it is remarkable that 15% of visitors reported that neither they nor anyone in their group noticed it. These visitors were obviously intently focused on other activities. Not all media are appropriate for all visitors.

Finally, and perhaps most importantly, the descriptions used to augment the visualizations were not pretested with the visiting public, so there is no way of knowing if – in fact – they were as useful as they could have been, and the staff members used to help visitors interpret the SOS, while knowledgeable about the SOS content and global and biological processes, were not trained interpretive specialists.

There are suggestions in the data that the globe would have a greater effect on the overall experience of the Amazonia Science Gallery if it had engaged visitors in a way that was more interactive or that directly encouraged group discussion. The association between higher ratings and engaging interactive activities such as bones, microscopes, and in-group discussions of SOS suggest that the SOS might be more effective for visitors as an interactive than as a presentation display.

The surveys of *Science on a Sphere*® were conducted soon after the installation. The study demonstrates that visitors to the Amazonia Science Gallery are attracted to SOS and that in order for

[10] It should also be noted that the position of the Amazonia Exhibit within the zoo is such that most visitors arrive there at the end of their zoo visit. As a result, it is likely that the interest of these visitors in seeing animals is especially strong, and that they are also somewhat tired, and thus less likely to be willing to struggle to understand something that is not immediately clear and relevant.

SOS to reach its full potential in satisfying and informing visitors, staff needs to learn new and improved ways to present information and new content using SOS. The results of this study suggest a number of possible improvements that could be tested relatively easily. Some of these ideas have been suggested by NZP to NOAA in a recent document supporting a no-cost extension to the grant. Among these are:

- Conduct an additional series of evaluations that will address questions about suitability of content and the effectiveness of different SOS presentation techniques to diverse target audiences.
- Organize and host a one-day workshop/meeting of the SOS institutions in the local region (Maryland Science Center; Goddard Space Flight Center; National Museum of Natural History; Nautica in Norfolk, VA; NZP) to get together, share ideas on what works and what doesn't and develop collaborations. Such meetings could take place among regional SOS facilities once or twice a year on a rotating basis. NZP staff could visit institutions that are leaders in SOS innovation to learn about the most current techniques and technologies in use for presentations, content development and possible collaborations.
- Produce new content based on Smithsonian and NZP science activities that can be field tested with visitors as it is being developed to determine how best to communicate science content to zoo visitors in the zoo exhibit context.

Appendix A. Questionnaires

5256440590 **Baseline Study of the Amazonia Science Gallery at the National Zoological Park**

Hi. My name is ____. I work for the Smithsonian. I'm talking to people today about their experiences in the Amazonia Science Gallery (the big room you just left).

1. Is today your first visit to this Amazonia building?
   - ○ Yes [IF YES GO TO Q2]
   - ○ No 1a. How many times have you been here before today? ☐☐

1b. Have you spent time in the Science Gallery (the big room you just left) before today?
   - ○ Yes
   - ○ No

2. How would you rate your overall experience in the Science Gallery in Amazonia (the big room you just left)? [SHOW CARD ONE #1]
   - ○ Poor (A)
   - ○ Fair (B)
   - ○ Good (C)
   - ○ Excellent (D)
   - ○ Superior (E)

3. What did you do in the Science Gallery? (Probe by asking: "Anything else?") [MARK ALL THE CIRCLES THAT APPLY]
   - ○ ☐ a. Live animal displays
   - ○ ☐ b. Microscope displays
   - ○ ☐ c. Bones
   - ○ ☐ d. Computer interactive station
   - ○ ☐ e. Earthquake/volcano display (near Globe)
   - ○ ☐ f. Video
   - ○ ☐ g. Get out of the sun (A/C)
   - ○ ☐ h. Bathrooms
   - ○ ☐ i. Interaction with lab staff
   - ○ ☐ j. Books
   - ○ ☐ k. Pictures, posters, art on walls
   - ○ ☐ l. GIS materials (transparencies)
   - ○ ☐ m. Panels
   - ○ ☐ n. Maps
   - ○ ☐ o. Objects in display case (ie- feathers, etc.)
   - ○ ☐ p. Animal diets
   - ○ ☐ q. Discussed Gallery's subject matter
   - ○ ☐ r. Globe
   - ○ ☐ s. other _____

4. Which of those activities was most interesting to you? [MARK ONE SQUARE IN Q3]

Today, we're talking to people about the globe in the Science Gallery:
[IF Q3r. IS MARKED GO TO Q6, BUT IF BLANK GO TO Q5]

5. Did you (or your child/children) see it?
   - ○ Yes (respondent)
   - ○ Yes (member of group)
   - ○ No [IF NO, GO TO Q8]

6. Did you talk to anyone (in your group) about the globe?
   - ○ Yes ○ No

7. What did you talk about?
PROBE: Did it lead you to think about anything in particular?

8. ***Within six months this globe will be replaced with a new active globe, that shows images moving across it. We are considering projecting the following images on the new globe.*** [SHOW CARD #2]

Which of these is most interesting to you?
8.a) What would be your second choice?
8.b) What would be your third choice?

1st	2nd	3rd	
○	○	○	A. Animal migrations
○	○	○	B. Astronomy
○	○	○	C. Changing global landscapes
○	○	○	D. Earth at night
○	○	○	E. Earth's biodiversity
○	○	○	F. Earth's landscapes
○	○	○	G. Earthquakes and volcanoes
○	○	○	H. Fires around the globe
○	○	○	I. Frog/amphibian crisis
○	○	○	J. Global climate change
○	○	○	K. Global weather
○	○	○	L. Oceans

A few last questions about you:

9. Where do you live?
   - ○ United States, zipcode: ☐☐☐☐☐
   - ○ Other coutry: _____

10. Who are you here with?
   - ○ Alone
   - ○ With others:
     - ☐☐ Adults 18 & older
     - ☐☐ Youth 12 to 17
     - ☐☐ Children 2 to 11
     - ☐☐ Children under 2

11. What is your age? ☐☐

12. Gender [MARK]
   - ○ Male ○ Female

THANK YOU for your time and participation in this survey!

Ses ☐☐ Seg ○○○ 1 2 3 Stat ○○○○ C R L I Int ☐☐ ID ☐☐☐

2008 Questionnaire

0031547942 **Follow Up Study of the Amazonia Science Gallery at the National Zoological Park**

Hi. My name is _____. I work for the Smithsonian. I'm talking to people today about their experience in the Amazonia building.

1. Is today your first time to Amazonia ?
   - ☐ Yes [If yes go to Q2]
   - ☐ No 1a. How many times have you been here before today? ☐☐
1b. Have you spent time in the Science Gallery (the big room you just left) before today?
   - ☐ Yes ☐ No
2. How would you rate your overall experience in the Science Gallery? [Show card 1]
   - ☐ Poor (A) ☐ Fair (B) ☐ Good (C)
   - ☐ Exc. (D) ☐ Sup. (E)
3. What did you do in the Science Gallery? [Mark in squares]. Probe: "Anything else?"
   - ☐ O Live Anima Displays (in Amazonia)
   - ☐ O Live Anima Displays (Frogs) –
   - ☐ O Pachinko Machine (Frogs)
   - ☐ O Chytrid Fungus Model (Frogs)
   - ☐ O Read about frogs
   - ☐ O **Globe**
   - ☐ O Bones
   - ☐ O Microscopes
   - ☐ O Computers
   - ☐ O Videos: _____
   - ☐ O Interact with staff: _____
   - ☐ O Books
   - ☐ O Maps
   - ☐ O Pictures, posters, art on wall
   - ☐ O
   - ☐ O Get out of the sunheat
   - ☐ O Use the Bathrooms
   - ☐ O Sit down and rest
   - ☐ O Other: _____
4. Which of those activities was most interesting to you? [Mark in circle in Q3]

Today we are talking to people about the Globe in the Science Gallery.

[If Q3 Globe is marked go to Q6, but if blank go to Q5]

5. Did you (or your child/children) see it?
   - ☐ Yes (respondent)
   - ☐ Yes (member of group)
   - ☐ No [If No, go to Q11]
6. Did you talk to anyone in your group about the Globe?
   - ☐ Yes ☐ No
7. What did you talk about? Probe: Did it lead you to think about anything in particular?

3b. How would you rate that exhibition you saw about frogs and amphibians in this room? [Show card 1]
   - ☐ Poor (A) ☐ Fair (B) ☐ Good (C)
   - ☐ Exc. (D) ☐ Sup. (E)

☐☐

Sex ☐☐ Segment O O O 1 2 3 Status O O O O C R L I Int ☐☐

Condition: descriptions on the globe

9a. Did you notice any explanatory text on the globe?
   - ☐ Yes ☐ No
8. How can we improve the Globe?

☐☐

Condition: staff present

8. How can we improve the Globe?

☐☐

9b. Did you talk to a zoo staff member about the Globe?
   - ☐ Yes ☐ No
9c. What did you talk about?

☐☐

10. Today, which of these images did you see? [Hand picture cards; mark in squares]
   - O ☐ A. Blue Marble
   - O ☐ B. Hurricanes
   - O ☐ C. Sea Currents
   - O ☐ D. Sea Surface Temperature
   - O ☐ E. X-Ray Sun
   - O ☐ F. Red Mars
   - O ☐ G. Tsunam
   - O ☐ H. Aerosol Black Carbon and Sulfate
   - O ☐ I. GFDL Temperature Model (global warming)
   - O ☐ J. Earth at Night

10b. For each one that you saw, can you say something about what they show? [note letter of card & record response]

11. Do you live in the United States or another country?
   - ☐ United States, specify zipcode: ☐☐☐☐☐
   - ☐ Another country, specify: _____
12. Who are you with?
   - ☐ Alone ☐ With Others
   - ☐☐ Adults (18 and over) ☐☐ Children 2 to 11
   - ☐☐ Youth 12 to 17 ☐☐ Children Under 2
13. What is your age? ☐☐
14. Gender [Mark] ☐ Male ☐ Female

Thank you for your time and participation in this survey!

ID ☐☐☐

2009 Questionnaire

Field Data: 2008 and 2009

2008 Condition: Pre-SOS

Ses.	Date	Day	Time	Total Count	Complete	Refusal	Ineligable	Total Eligible	Response Rate	Total Intercepts	Saw Geo-sphere
1	3-Jul		12-1:30	154	22	4	2	26	84.62%	28	
2	3-Jul		1:30-3	191	21	7		28	75.00%	28	
3	8-Jul		1-2:30	122	29	1		30	96.67%	30	
4	8-Jul		2:30-4	154	27	1	1	28	96.43%	29	
5	10-Jul		12-1:30	70	17	3	0	20	85.00%	20	
6	12-Jul		12:30-2	133	23	2		25	92.00%	25	
7	12-Jul		2-3:30	150	23	6	1	29	79.31%	30	
		Total Completes			162	24	4	186	87.10%	190	

2009 Condition: Baseline

Ses.	Date	Day	Time	Total Count	Complete	Refusal	Ineligable	Total Eligible	Response Rate	Total Intercepts	Saw the Globe
1	14-Jun	Sat	11:30-1	93	18	1	0	19	94.74%	19	17
2	22-Jul	Tues	12-1:30	185	19	3	10	22	86.36%	32	17
3			2-3:30	163	19	1	6	20	95.00%	26	17
4	25-Jul	Fri	11:30-1	217	24	5	5	29	82.76%	34	20
5			1:30-3	306	24	1	6	25	96.00%	31	24
6	31-Jul	Thur	11:30-1	205	25	1	3	26	96.15%	29	20
		Total Completes			129	12	30	141	91.49%	171	115

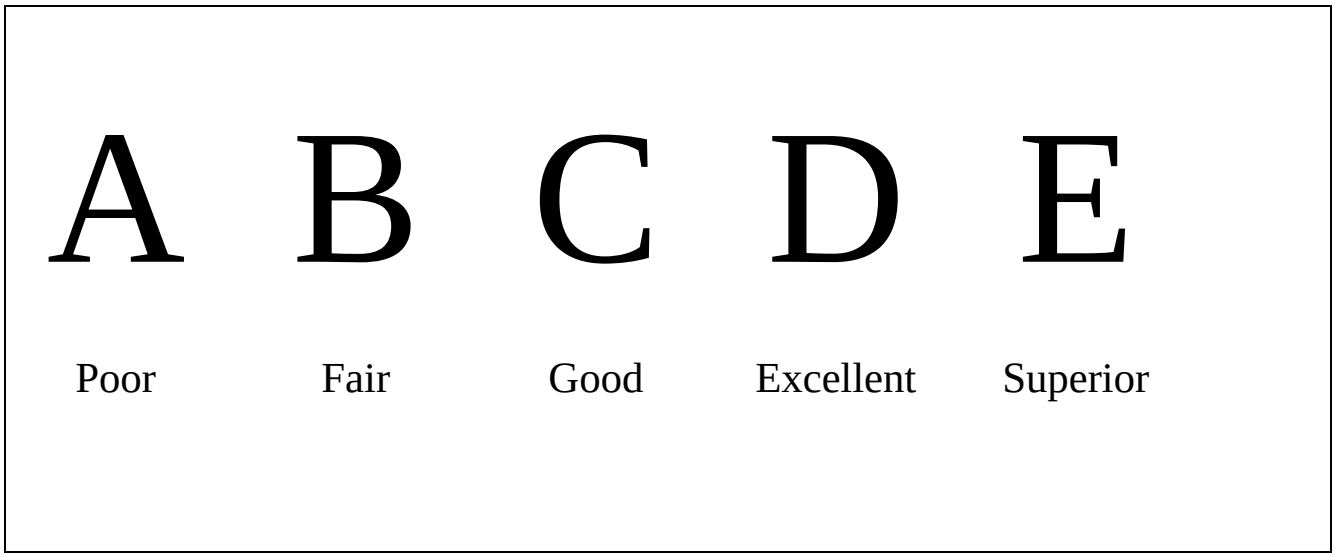
2009 Condition: Descriptions on Globe

Ses.	Date	Day	Time	Total Count	Complete	Refusal	Ineligable	Total Eligible	Response Rate	Total Intercepts	Saw the Globe
7	29-Jul	Tues	11:30-1	178	22	1	7	23	95.65%	30	21
8			1:30-3	199	25	1	7	26	96.15%	33	21
9	31-Jul	Thur	1:30-3	268	29	3	2	32	90.63%	34	22
10	2-Aug	Sat	12-1:30	420	29	4	9	33	87.88%	42	25
11			2-3:30	524	29	6	6	35	82.86%	41	19
		Total Completes			134	15	31	149	89.93%	180	108

2009 Condition: Staff Presenting

Ses.	Date	Day	Time	Total Count	Complete	Refusal	Ineligable	Total Eligible	Response Rate	Total Intercepts	Saw the Globe
12	4-Aug	Mon	11:30-1	231	29	2	4	31	93.55%	35	20
13			1:30-3	362	33	3	8	36	91.67%	44	29
14	6-Aug	Wed	12-1:30	229	26	0	11	26	100.00%	37	21
15			2-3:30	269	32	2	2	34	94.12%	36	22
16	8-Aug	Fri	12-1:30	252	15	1	1	16	93.75%	17	12
17			2-3:30	329	14	3	2	17	82.35%	19	13
		Total Completes			149	11	28	160	93.13%	188	117

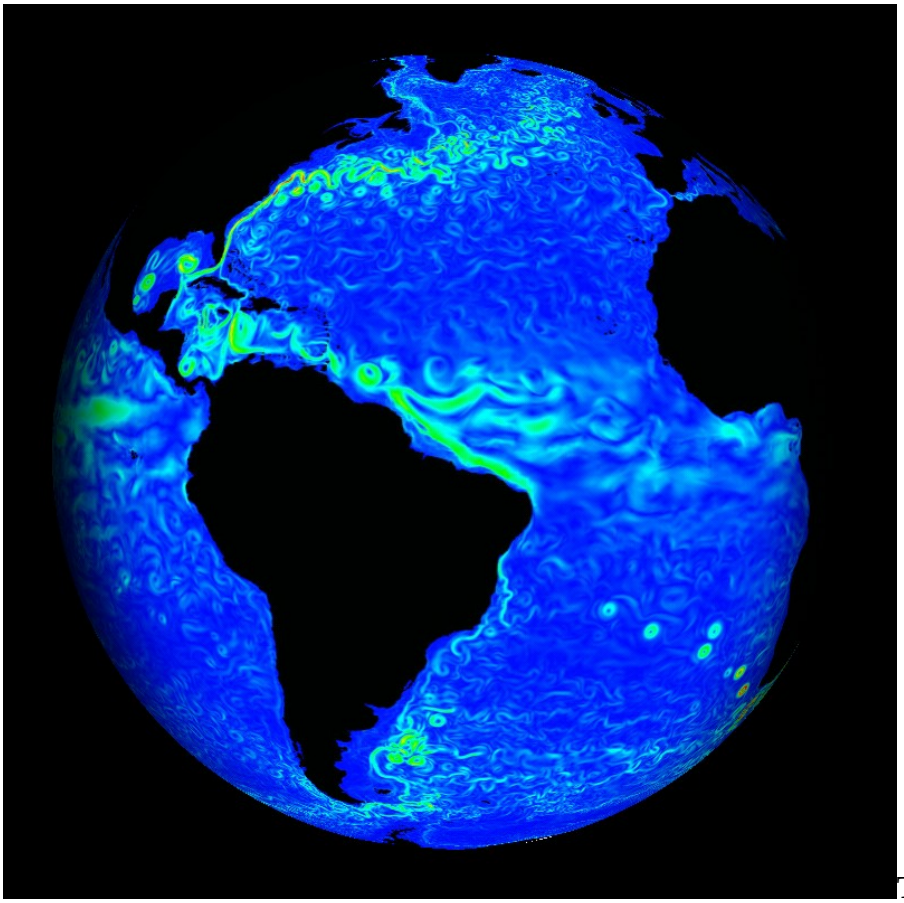
Appendix B. Cards Shown to Survey Respondents



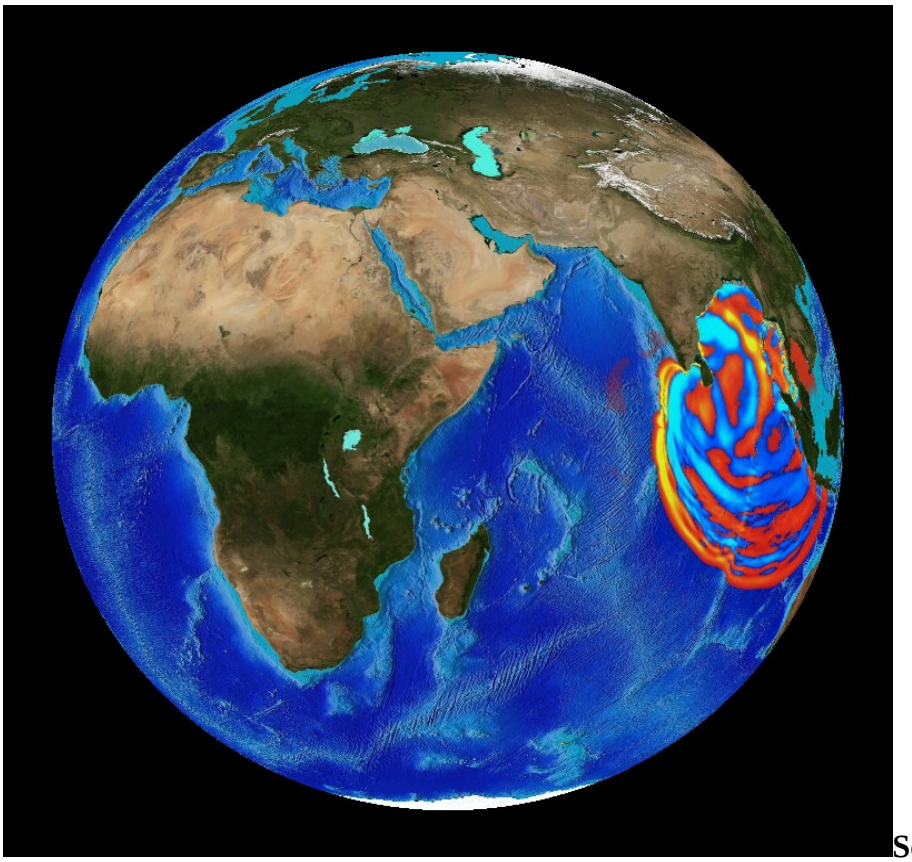
Rating Card

Globe Images

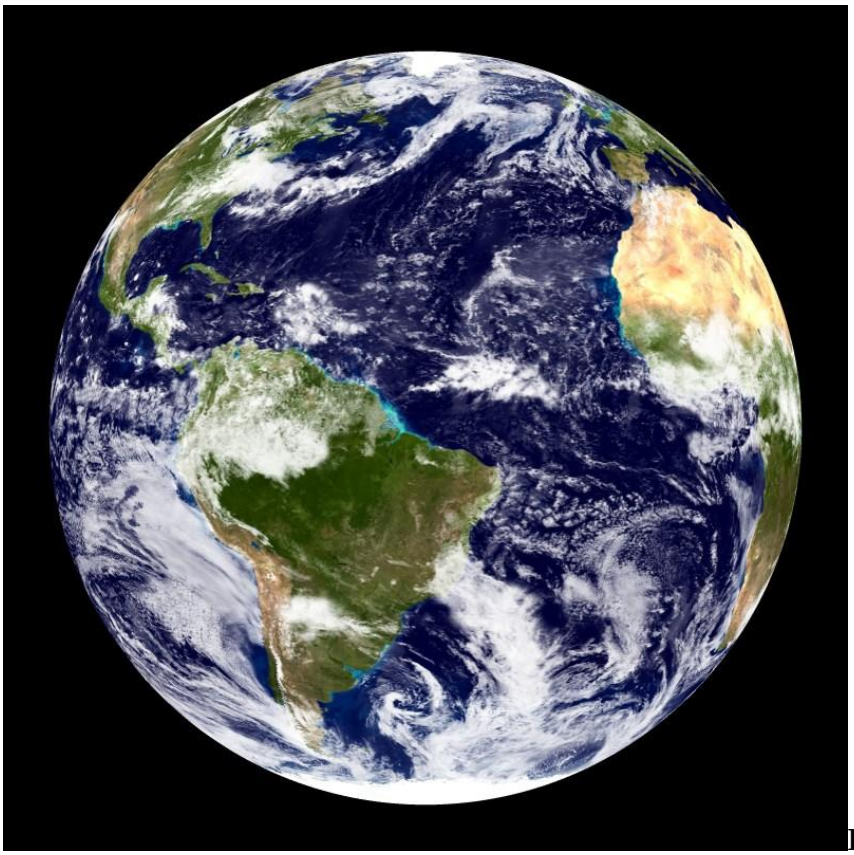
The ten images shown to respondents were 11” x11” photos mounted on cards.



Tsunami

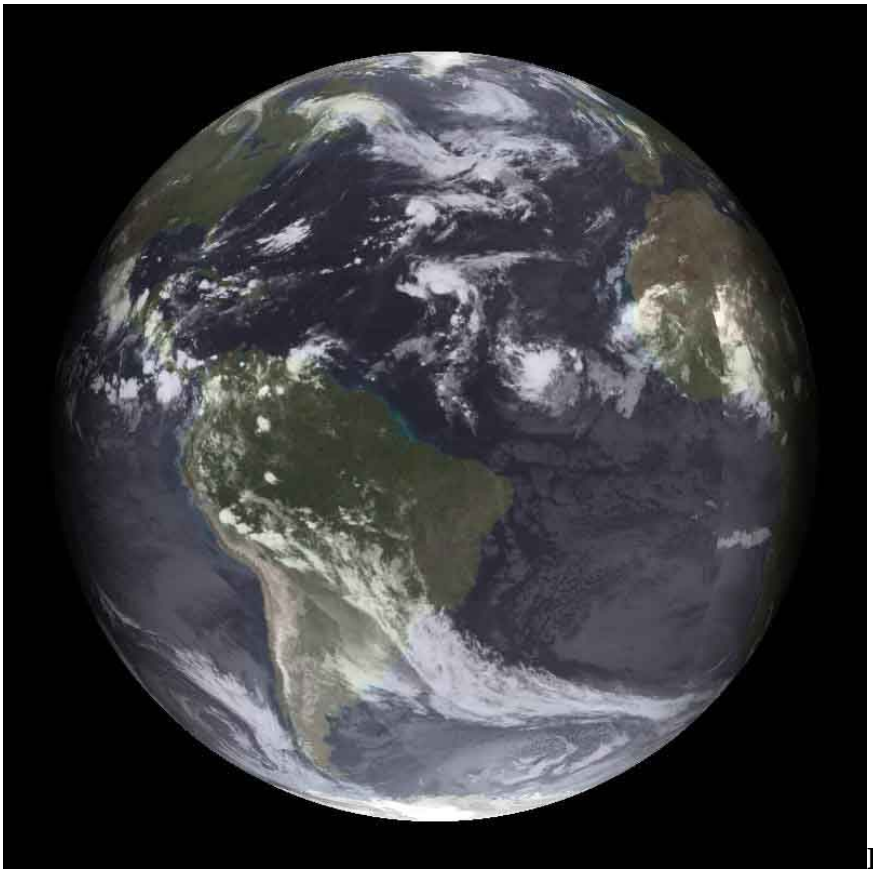


Sea Currents

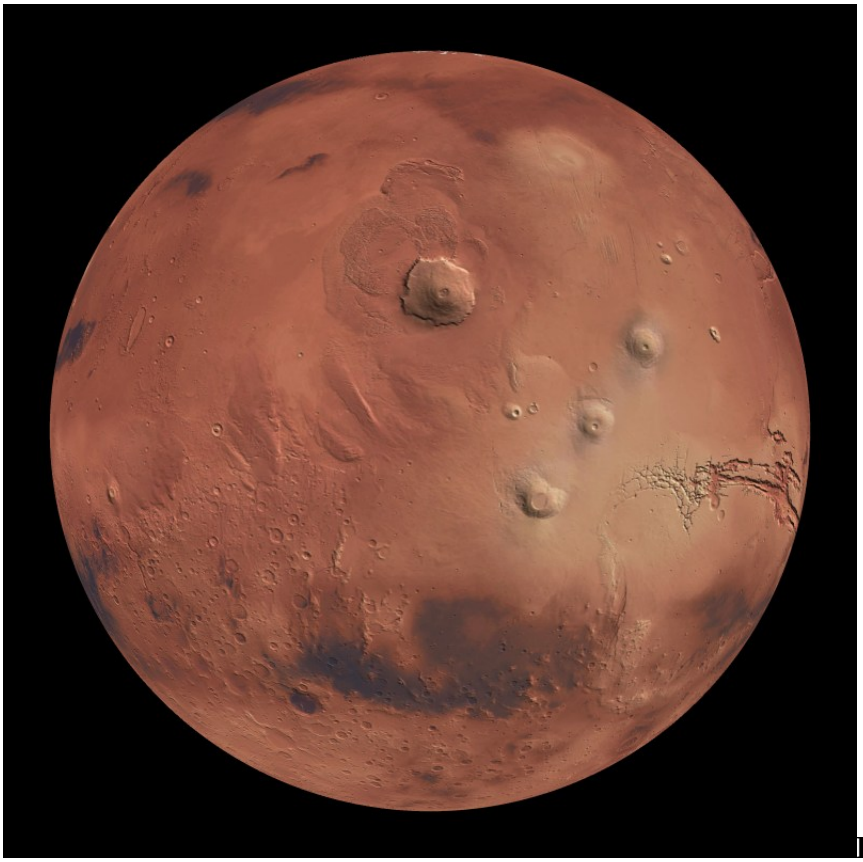


Blue Marble

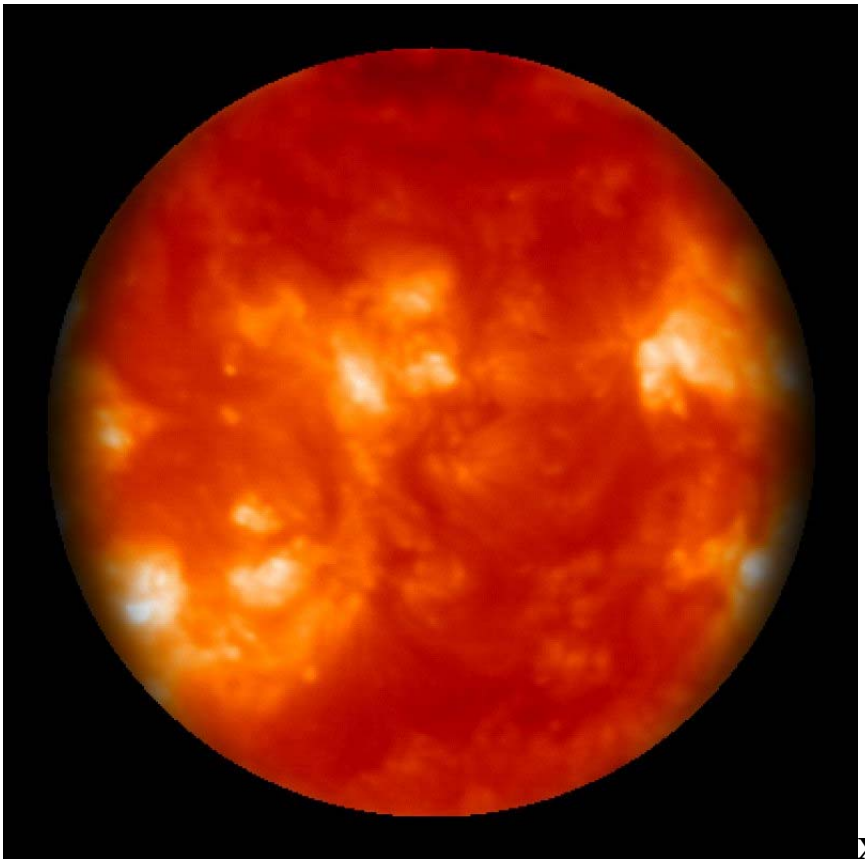
Earth at Night



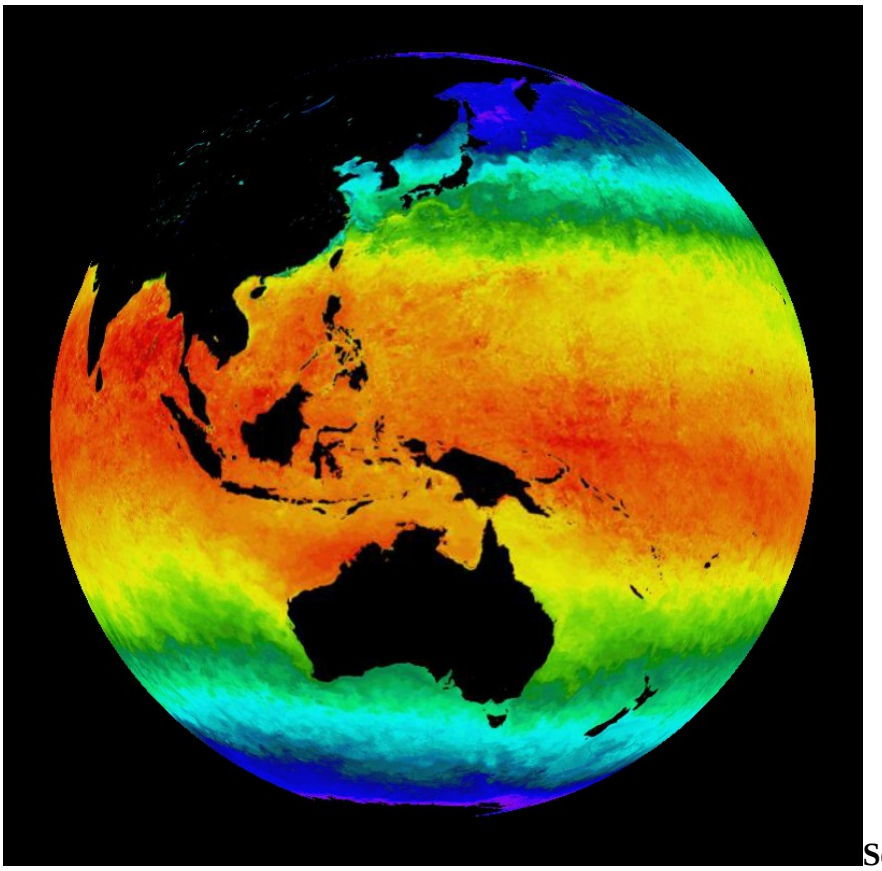
Hurricanes



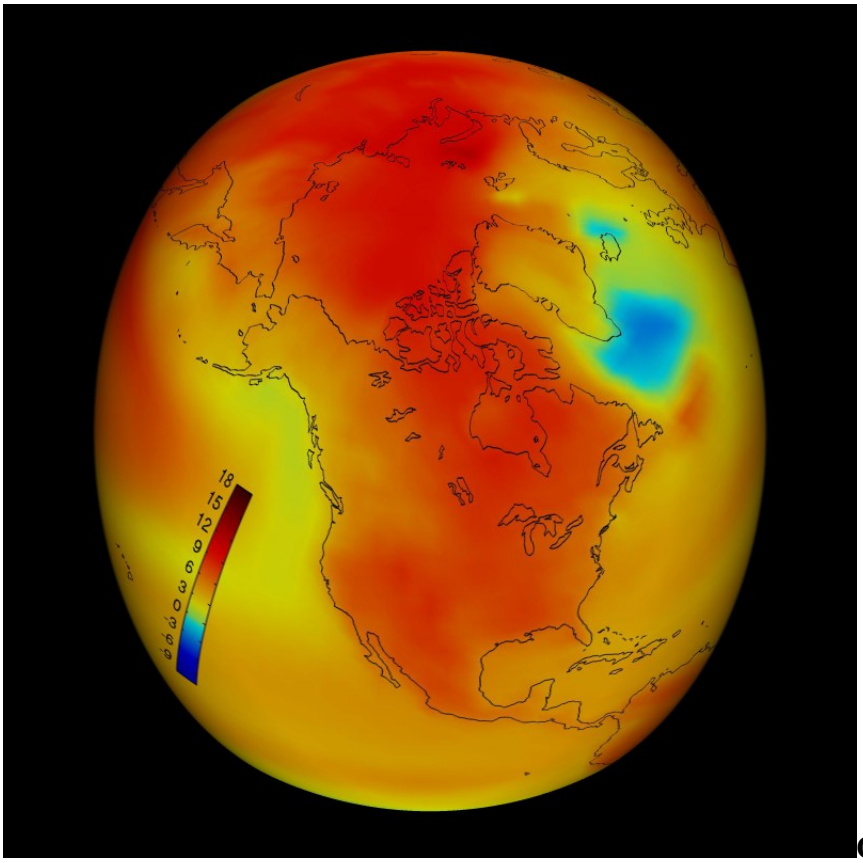
Red Mars



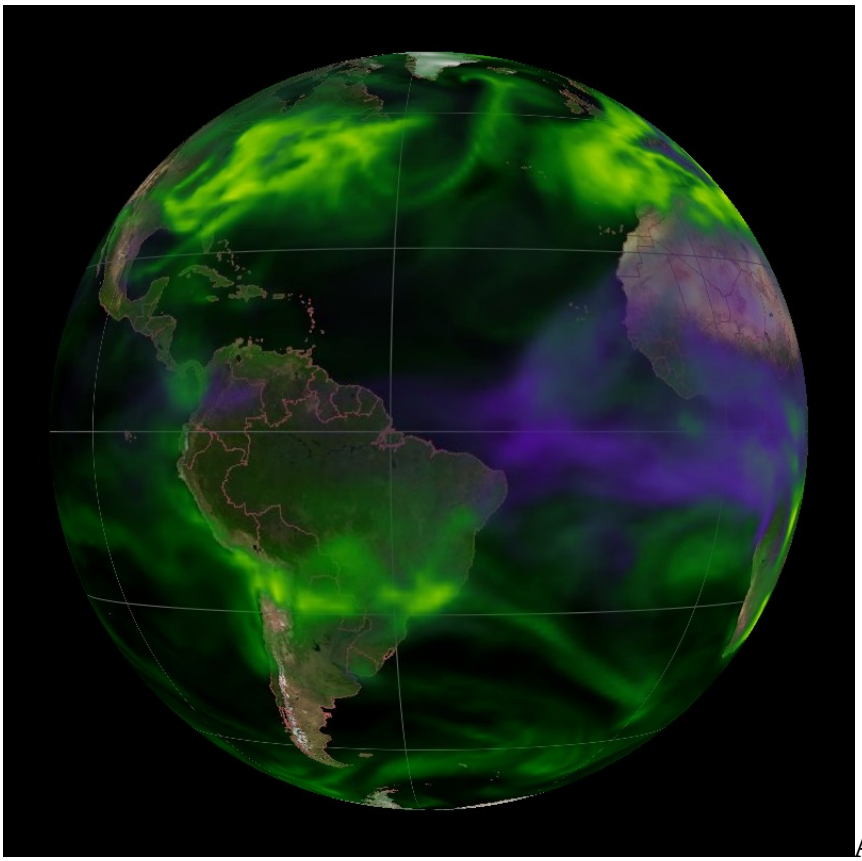
X-Ray Sun



Sea Surface Temperature



GFDL Temperature Model



Aerosol Black Carbon and Sulfate

Appendix C. Frequencies

		Science on a Sphere			
	2008	**Context 1**	**Context 2**	**Context 3**	**Total**
	Pre-SoS	**Baseline**	**Descriptions**	**Staff present**	**2009**
	N=162	N=129	N=134	N=149	412
Is today your first visit to Amazonia?*					
Yes	73	68	58	73	67
No	27	32	42	27	33
Total	**100**	**100**	**100**	**100**	**100**
If no, how many times have you been here before today?					
(Average number of times)	(4.3 times)	(6.2 times)	(6.1 times)	(3.4 times)	(5.3 times)
(Median number of times)	(3 times)	(4 times)	(4 times)	(3 times)	(4 times)
If no, Have you spent time in the Science Gallery before today?					
Yes	60	59	67	53	61
No	40	41	33	47	39
Total	**100**	**100**	**100**	**100**	**100**
(Combined result)					
First visit to Science Gallery	84	81	72	86	80
Repeat visit to Science Gallery	16	19	28	14	20
Total	**100**	**100**	**100**	**100**	**100**
How would you rate your overall experience in the Science Gallery?					
Poor	0	0	0	0	0
Fair	6	2	2	4	3
Good	23	25	21	24	23
Excellent	49	50	63	55	56
Superior	22	23	15	17	18
Total	**100**	**100**	**101**	**100**	**100**
What did you do in the Science Gallery? (Multiple responses)					
Live Animal Displays (Amazonia)	69	39	47	43	43
Live Animal Displays (Frogs)	NA	67	71	58	65
Pachinko machine (Frogs)	NA	1	2	0	1
Chytrid Fungus Model (Frogs)	NA	3	6	1	3
Read about Frogs	NA	3	8	9	7
Bones*	24	25	**11**	20	19
Microscopes*	42	**36**	19	31	29
Computers	23	4	4	4	4
Videos	19	8	4	2	4
Interacted with staff	7	2	2	1	2
Books	14	5	11	10	9
Maps	7	1	1	1	1
Pictures/posters/art on wall	8	1	1	3	2
GIS materials (transparencies)	8	0	1	0	0
Get out of the sun/heat	NA	1	1	0	1
Use the bathrooms	17	6	3	9	6
Sit down and rest	NA	2	1	4	3
Globe*	**22**	**65**	**48**	**57**	**56**
Other [excluded from Total]	18	9	2	4	5
Total	**260**	**269**	**241**	**253**	**255**
(Average number of activities)	(2.6 activities)	(2.8 activities)	(2.4 activities)	(2.6 activities)	(2.6 activities)

		Science on a Sphere			
	2008	Context 1	Context 2	Context 3	Total
	Pre-SoS	Baseline	Descriptions	Staff present	2009
	N=162	N=129	N=134	N=149	412
Which of these activities was most interesting to you?					
Live Animal Displays (Frogs)	NA	35	34	19	30
Live Animal Displays (Amazonia)	41	18	23	33	25
Globe	6	25	24	27	25
Microscopes*	17	10	7	12	10
Bones*	7	4	0	1	2
Books	2	0	0	2	1
Videos	7	0	3	0	1
Pachinko machine (Frogs)	NA	1	1	0	1
Interacted with staff	2	1	1	0	1
Multiple things/Could not select one	18	7	6	5	6
Total	**100**	**101**	**99**	**99**	**102**
Did you (or your child/children) see the Globe? (Multiple responses)					
Yes, I/we did	87	88	82	83	84
Yes, someone in my group did	42	33	40	39	37
No one in my group saw the Globe	9	10	18	15	15
Total	**138**	**131**	**140**	**137**	**136**
If yes, did you talk to anyone in your group about the Globe?					
Yes	27	43	37	29	36
No	73	57	63	71	64
Total	**100**	**100**	**100**	**100**	**100**
(Combined result)					
Only the respondent saw the globe		57	42	46	48
Only a member of group saw the globe		2	0	2	1
Both respondent and member saw globe		31	40	37	36
No one in the group the Globe		10	18	15	15
Total		**100**	**100**	**100**	**100**
(Combined result)					
Talked about the Globe within the group		39	30	25	31
Did not talk about the Globe		51	52	60	54
No one in the group saw the Globe		10	18	15	15
Total		**100**	**100**	**100**	**100**
Did you notice any explanatory text on the Globe?					
[Note: Asked on in Condition 2] Yes	NA	NA	57		
No	NA	NA	44		
Total	NA	NA	**101**		
Did you talk to a zoo staff member about the Globe?					
Yes	NA	NA	NA	75	75
No	NA	NA	NA	25	25
Total	NA	NA	NA	**100**	**100**

		Science on a Sphere			
	2008	Context 1	Context 2	Context 3	Total
	Pre-SoS	Baseline	Descriptions	Staff present	2009
	N=162	N=129	N=134	N=149	412
Today, which of these images did you see? (Multiple responses)					
Blue Marble	NA	35	24	25	28
Hurricanes	NA	22	20	24	22
Sea Currents*	NA	28	20	35	28
Sea Surface Temperature	NA	19	17	19	19
X-Ray Sun	NA	20	17	25	21
Red Mars*	NA	13	12	33	20
Tsunami	NA	26	26	29	27
Aerosol Black Carbon and Sulfate	NA	15	11	15	13
GFDL Temperature Model*	NA	22	11	20	18
Earth at Night*	NA	17	15	30	21
Total	NA	**217**	**173**	**255**	**217**
(Average number of images)	NA	(2.2 images)	(1.7 images)	(2.5 images)	(2.2 images)
(Median number of images)	NA	(2 images)	(1.9 image)	(2 images)	(2 image)
(Incorrectly identified)					
Blue Marble	NA	5	2	4	4
Hurricanes	NA	15	10	16	13
Sea Currents	NA	12	5	9	9
Sea Surface Temperature	NA	8	2	9	6
X-Ray Sun	NA	10	5	5	6
Red Mars*	NA	7	2	10	6
Tsunami	NA	15	14	14	14
Aerosol Black Carbon and Sulfate	NA	9	5	6	7
GFDL Temperature Model*	NA	5	3	10	6
Earth at Night*	NA	7	1	5	4
Total	NA	**93**	**49**	**88**	**75**
(Average number incorrectly identified)	NA	(0.9 image)	(0.5 images)	(0.9 image)	(0.8 images)
(Median number incorrectly identified)	NA	(1 images)	(0 images)	(1 images)	(0 images)
Do you live in the United States or another country?					
United States	92	96	96	94	95
Another country	8	4	5	6	5
Total	**100**	**100**	**101**	**100**	**100**
(Residence by distance from the Mall)					
Within 5 miles	4	9	5	3	5
Within 6-10 miles	8	8	11	6	8
Within 11-20 miles	14	10	17	13	13
Within 21-40 miles	11	11	13	15	13
Within 41-100 miles	13	12	21	10	15
Within 101-250 miles	10	15	11	10	12
More than 250 miles	34	32	18	37	29
International	8	4	5	6	5
Total	**102**	**100**	**101**	**100**	**100**

		Science on a Sphere			
	2008	Context 1	Context 2	Context 3	Total
	Pre-SoS	Baseline	Descriptions	Staff present	2009
	N=162	N=129	N=134	N=149	412
(Residence by geographical region)					
Washington, DC, Metropolitan Area	19	25	31	19	25
Southeast	26	27	23	21	24
Mid-Atlantic	22	23	30	31	28
Midwest	4	7	2	8	6
New England	4	6	4	5	5
Mountain Plains	9	4	2	7	4
West	7	3	2	3	3
Unspecified U.S.	1	4	5	6	5
International	8	2	2	0	1
Total	**100**	**101**	**101**	**100**	**101**
Who are you with?*					
Alone	4	4	8	1	4
With others	96	96	92	99	96
Total	**100**	**100**	**100**	**100**	**100**
If with others:					
Number of adults (average)	(1.5 adults)	(1.7 adults)	(1.6 adults)	(1.4 adults)	(1.5 adults)
Number of Youth 12-17 (average)	(0.4 youth)	(1.7 youth)	(1.4 youth)	(1.7 youth)	(1.7 youth)
Number of Children 2-12 (average)	(1.2 children)	(1.7 children)	(1.8 children)	(1.7 children)	(1.7 children)
Number of Children under 2 (average)	(0.1 infants)	(1 infants)	(1.0 infants)	(1.2 infants)	(1.1 infants)
(Group size*)					
Alone	4	4	8	1	4
Two	21	34	20	25	26
Three to five	58	54	66	64	61
Six or more	17	8	7	10	8
Total	**100**	**100**	**101**	**100**	**99**
(Group composition)*					
Adult alone	4	4	8	1	4
Youth/child(ren) group	2	5	2	2	3
Adults-only group	20	21	22	12	18
Adults and youth/child(ren)	74	71	69	85	75
Total	**100**	**101**	**101**	**100**	**100**
What is your age?					
(Mean)	(37 years)	(34.7 years)	(33.7 years)	(35.5 years)	(34.7 years)
(Median)	(37 years)	(33.8 years)	(32 years)	(37 years)	(35 years)
(Age grouped by generations)					
Postwar (born 1928-1945)	5	3	2	3	3
Leading Edge Boomers (born 1946-1954)	8	5	4	7	5
Trailing Edge Boomers (born 1955-1965)	17	20	14	21	18
Generation X (born 1966-1976)	46	25	28	32	28
Generation Y (born 1977 or later)	24	47	52	38	45
Total	**100**	**100**	**100**	**101**	**99**

		Science on a Sphere			
	2008	**Context 1**	**Context 2**	**Context 3**	**Total**
	Pre-SoS	**Baseline**	**Descriptions**	**Staff present**	**2009**
	N=162	N=129	N=134	N=149	412
(Age grouped by five-year cohorts)*					
12 to 19	12	18	13	18	16
20 to 24	10	9	13	6	9
25 to 29	11	9	18	7	11
30 to 34	11	16	7	12	12
35 to 39	12	11	18	12	14
40 to 44	16	15	10	18	15
45 to 49	10	9	7	15	11
50 to 54	6	5	6	3	5
55 to 59	6	3	2	5	3
60 to 64	2	2	3	4	3
65 to 69	3	2	2	1	2
70 or older	1	1	1	0	1
Total	**100**	**100**	**100**	**101**	**102**
(Four-way age distribution)					
12 to 20	13	19	17	21	19
21 to 35	34	34	37	24	31
36 to 49	34	34	33	43	37
50 or older	19	14	13	12	13
Total	**100**	**101**	**100**	**100**	**100**
Gender					
Male	39	51	42	48	47
Female	61	49	58	52	53
Total	**100**	**100**	**100**	**100**	**100**
How would you rate your personal experience of the Frogs exhibition?					
Poor	NA	NA	1	0	1
Fair	NA	NA	1	1	1
Good	NA	NA	17	28	22
Excellent	NA	NA	47	40	44
Superior	NA	NA	34	32	33
Total		NA	**100**	**101**	**101**

Note: Sums of 99, 101, or 102 are due to rounding.
*Significant differences across conditions