

**Summative Evaluation of
Science On a Sphere Programs
at the
Denver Museum of Nature & Science**



**Prepared by
People, Places & Design Research**

Summative Evaluation of Science On a Sphere Programs at the Denver Museum of Nature & Science

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Executive Summary

This summative evaluation of Science On a Sphere (SOS) programming at the Denver Museum of Nature & Science (DMNS) was commissioned to assess visitor experiences with climate related content on this unusual dynamic presentation tool. In general, the goal was to investigate the value of SOS presentations for visitors – their reactions, perceived messages relating to climate literacy, and their understanding of various types of data visualizations – in light of the particular way that DMNS has created and implemented SOS programming as an integral part of the Space Odyssey permanent exhibition. This work was supported by a grant from NASA, and is intended to become part of the literature of the SOS network.

To get the most information from this evaluation process, an experimental design was created in which two different types of climate literacy content – Earth focused and comparative planetology based – were used in three different modes: Auto-run, Facilitated, and Shows. ‘Auto-run’ mode meant that visitors viewed SOS on their own; ‘Facilitated’ mode meant that a volunteer encountered individual visitor groups and engaged them in a discussion for as long as the visitors remained; ‘Show’ mode meant a more-formal presentation, announced on the PA system, lasting about 18-20 minutes, with seating. Following their experiences with SOS, a minimum of 50 visitor groups were interviewed in each of six conditions, yielding a total sample of 378 visitor groups. The characteristics of audiences were mostly similar across the six conditions of this experimental design, although there was a higher proportion of families with children attracted to the Show and Facilitated modes.

| Two different types of content: | | |
|--|----------------------------------|---|
| Three modes: | Earth content: “See the Seas” | comparative planetology: “A Tale of 3 Planets” |
| Auto-run mode | n=58 | n=71 |
| Facilitated mode | n=67 | n=78 |
| Show mode | n=53 | n=51 |
| | n=378 | |



Formal presentation = 'show' mode



Informal presentation = 'facilitated' mode

Highlights of the Findings

The findings from this evaluation focus on evidence about visitors' enjoyment of an SOS experience, visitors' understanding of climate related interpretive messages and data visualizations, and how different modes of engaging visitors yield different experiences.

- **Overall reactions:**

High ratings: The two programs created by DMNS – *See the Seas* and *A Tale of Three Planets* – were highly rated by visitors. Approximately 65% of visitors interviewed after their SOS experience gave '9' or '10' ratings on a 10-point scale for either program; this is an impressive high rating for exhibits.¹

Broad appeal: These SOS programs appealed similarly to various segments of the visitor audience: families with children as well as adults visiting without children, people who have seen SOS before as well as those seeing it for the first time, and people who believe that climate change is influenced by humans as well as those who don't.

Difference by mode of presentation: Visitors especially liked the Facilitators (80% 'high' ratings). The Show mode was also well-received and the Auto-run mode was moderately well-received (63% and 53% high ratings respectively). The Auto-run mode was more interesting for people with special knowledge or background in planetary or earth sciences, and less interesting to those with no special background, suggesting that the content was less accessible to them on their own.

- **Extent of exposure to data sets and other information:**

More vs. fewer datasets: Visitors who watched an 18-20 minute Show saw more datasets and topics than people viewing the other presentation modes, which is a benefit for their ability to understand the content.

Use of the supplemental HD video screens: Nearly all visitors who viewed Auto-run mode (92%) said they read the interpretive text on the monitors mounted on the walls around the SOS sphere. There was less awareness and use of those screens in the Show mode or the Facilitated mode, during which visitors were engaged with a live speaker.

- **Interpretive messages:**

Better understanding: The vast majority of visitors (85%) felt that they understood something better after seeing Science On a Sphere, across both program topics (*See the Seas* and *A Tale of Two Planets*) and all three modes of presentation.

Specific knowledge: Visitors who saw a Show of *See the Seas* were better able to answer a "test" question about the content (how ocean currents affect climate), probably because they saw more data sets including the one about ocean currents, and had an integrated narration about the global current. Visitors in both the Show and Facilitated modes were better able to answer a question about *A Tale of Three Planets* (how studying other planets tells you something about the climate on Earth), a message that was explicitly communicated in any live narrative, but not on its own in Auto-run mode.

- **Understanding select data visualizations from "See the Seas:"**

Mostly clear data visualizations: Interviewed soon after seeing SOS and at a distance

¹ Over many years of evaluating exhibits, we developed and validated the use of 9-or-10 on a 10-point scale as a measure of excellence in visitor experience. In over 60 summative evaluations, the proportion of such high ratings has ranged from about 20% to about 80%; few exhibits exceed 60% ratings of 9 or 10.

from the sphere, most visitors were able to accurately describe still images representing the visualizations about draining the ocean (with a legend), seafloor spread (with plates labeled), sea surface temperature (with a legend), and continental drift. Visitors had a hard time recognizing and understanding the chlorophyll image and tsunami waves (with a legend). Visitors thought that ocean acidification was the hardest visual to understand.

- **Understanding select data visualizations from “A Tale of Three Planets:”**
Less clear understanding of data visualizations of planets: Interviewed soon after seeing SOS and at a distance from the sphere, many people couldn’t identify which planet was represented in the still images (or tell the difference between Mars and Venus), including data visualizations of Mars day/night temperature, Mars MOLA (color), Venus (clouds/no clouds), and Venus volcanoes. However, visitors did understand that the red dots indicated volcanoes, and they recognized the arrangement of volcanoes on Earth.

Data and detailed findings on each of the above topics are presented in the technical report that follows this summary.

Conclusions and Implications

The findings of this evaluation provide a good case study of the effectiveness of Science On a Sphere at DMNS – a museum which has created custom programs to illustrate global climate relationships on Earth (*See the Seas*) as well as illustrating comparative planetology (*A Tale of Three Planets*). The findings also offer food-for-thought about each of the three modes of presenting Science On a Sphere, as well as about the ease or difficulty of understanding various data visualizations.

Benefits and drawbacks of a scripted Show (with seating):

- + People who sit down to watch a program as part of an audience will stay longer, so they see more data sets and more-complete programs.
- + Visitors can better grasp the intended messages and better understand what they are seeing when the content is explained and presented in a planned, coherent way. When audience participation is also included (e.g., trying to guess which planet) it serves to make the content more memorable.
- + A Show attracts more families with children because it seems more lively and engaging than viewing the sphere on their own. Another perspective is that adult-only groups may have avoided the Show because they thought it would be “just for kids” or they wanted to leave seating room for the families and children (when announced on the PA system, children often gathered in the front row of benches²). These shows were not “dumbed down” for kids, but there were plenty of younger children who stayed for the entire time.
- An 18-20 minute show is a relatively long commitment for visitors. Many people prefer to explore exhibits on their own, following their own interests for as long or as little time as they want.

² Depending on the timing of the show (especially the mornings), summer camp groups sometimes gathered to see a presentation. The presence of organized groups may have inhibited adults without children from watching the show, perhaps thinking that it was intended for a young audience.

Benefits and drawbacks of Facilitated programming:

- + Visitors really appreciate the opportunity for personal interaction with staff or volunteers.
- + Facilitators can respond to each visitor's level of prior knowledge and specific interests with a variety of datasets at their disposal, which may increase engagement (e.g., if a child wants to see Saturn the facilitator can oblige). In this way learning can be more 'visitor-driven' instead of "here's what we want you to learn."
- In this study the Facilitators' flexibility and ability to show extra datasets didn't necessarily lend itself to visitors' getting the intended messages, although people may have learned other things that weren't being "tested." With the *See the Seas* program, the criterion learning question (how ocean currents affect climate elsewhere on the planet) may not have been illustrated or explained by the data sets that facilitators showed. However, with *A Tale of Three Planets*, visitors were equally likely to grasp the criterion learning question (how studying other planets could help understand Earth's climate).

Benefits and drawbacks of Auto-run programming:

- + Visitors can observe the Sphere at any time they choose, and continue watching for as little or as long as they choose. This seems to work reasonably well for people with special knowledge or background in the subject.
- Auto-run of a series of data sets appears to be less accessible and engaging for people who don't have a background or special interest in the subject.
- When visitors with no prior knowledge or special background approach the sphere, they have no clear understanding of the point of it (except that it often shows the Earth and has cool images), and no idea as to whether it has a beginning-middle-end, and no idea about whether there would be different kinds of visuals, or how long a sequence or program of images would last. These are ambiguities that hardly matter when visitors are engaged with a Facilitator or when they gather on benches to see a Show, but for people independently viewing the sphere, these factors probably do matter because anecdotally it was sometimes a challenge to find people who looked at the sphere for a minimum of three data sets. Some type of briefly-stated invitation or main message – perhaps mounted on the rail or even creatively placed inside the railing on the floor (e.g., on a small low platform) – could help visitors understand what they can experience if they watch the sphere for a few minutes.

Understanding visualizations:

- + Visitors are pretty good at using legends or labels to help them understand a visualization if the unit of measurement is familiar (e.g., temperature, depth), but not so good with unfamiliar units (e.g., wave amplitude).
 - + The idea that other planets might have volcanoes or climates is new to most visitors, and they think that's interesting.
 - Visitors tend to interpret the color red as indicating heat (temperature), without clear information to the contrary (e.g., Japan tsunami waves, Mars MOLA); it's important to be aware of visitors' likely meanings of colors so they aren't misled.
 - Pictures of the Earth with oceans and continents feel familiar to visitors, even if they don't really understand what data are being shown (e.g., chlorophyll).
- Visitors have a harder time identifying other planets, so repeated reinforcement would be helpful when using images of other planets as well as switching from one planet to another.

Development of the evaluation strategy, design and method

At DMNS, Science On a Sphere is an integral part of the Space Odyssey exhibition. That fact had two very distinct implications for evaluating SOS programming:

- ◆ first, there is a strong and ongoing commitment to interpret content in Space Odyssey using volunteers, called Museum Galaxy Guides, and that mode of guide-facilitated interpretation is the dominant way that Science On a Sphere is presented to visitors (estimated by the Museum's SOS team at 85% of visitors' exposure to SOS);
- ◆ secondly, Space Odyssey covers a broad range of space-science topics, and SOS is often used to illustrate and compare planets other than Earth.

The strategy for summative evaluation needed to take these factors into account, and therefore it did not make sense to seek an average overall or "blended" measure of the effectiveness of SOS programming across different types of presentations and different types of content. The strategy that made the most sense was to represent the range of programming in a systematic way, which in this case meant:

three different modes of presentation: Auto-run, guide-facilitated, and scripted show (a formal presentation to a group of visitors); and

two different types of climate-related content—Earth-focused and comparative planetology-based.

This was the basis for deciding on an experimental design for the evaluation process, as noted at the beginning of the Executive Summary.

Investigating each of these factors not only helps to make a summative evaluation useful to DMNS, but each also has considerable relevance to the network of SOS sites. Regarding the mode of presentation, many sites keep their SOS on auto-run most of the time,³ while some do scripted shows about specific themes, and a few have docents or staff who are available to facilitate and explain visualizations to visitors in a more informal and customized way.

Regarding the content, many other SOS installations focus primarily on data sets about Earth (e.g., Blue Marble, Nightlights, Air Traffic, Sea Turtle Tracks) but some also use the Sphere to present information about other planets (e.g., Jupiter, Moon Phases, X-Ray Sun, Earth-like Exoplanet).⁴ Presumably, information about DMNS' range of modes of presentation, measured with more than one kind of content, could offer some context to other sites and perhaps implications for the visitor experience they seek.

³ In an analysis of how SOS is used, conducted for the University of Wisconsin, we found that only about 20 of 65-or-so sites in the U.S. used any kind of live narration (docents, facilitators, etc.) in their programming.

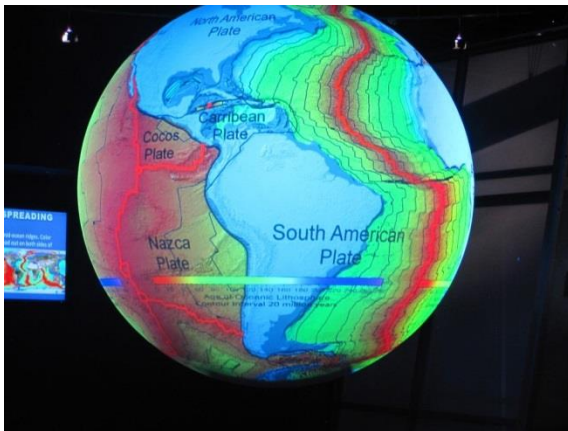
⁴ Based on observation of the range of presentations at the November 2012 national meeting of the SOS Network.

Evaluation Design

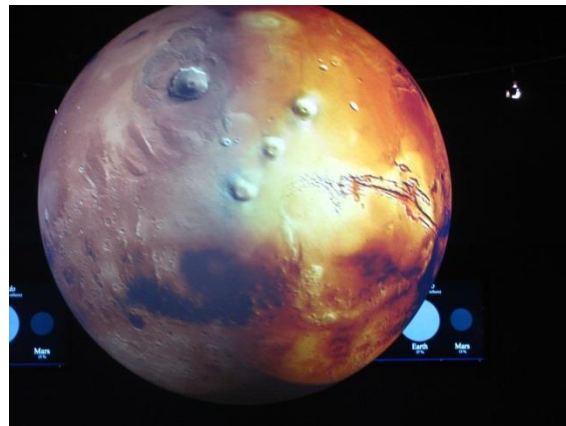
As described on page 1 of the Executive Summary, the 2 x 3 design of this summative evaluation was created to avoid the potential confounding of visitor reactions in different modes of experiencing SOS, as well as avoiding the potential problem of testing those experiences with only one type of content. This detailed investigation was in fact made possible by the normal diversity of programming that is offered at DMNS.

Specifically during the period of this NASA-funded project, DMNS developed two different scripted programs designed to enhance visitors' climate literacy: *See the Seas* for Earth-focused content (about oceans and climate) and *A Tale of Three Planets* for comparative planetology content (comparing the atmospheres and climates of Earth, Mars and Venus). In addition, interpretive text and graphics were developed to accompany the programs using HD video monitors mounted on the walls adjacent to the Sphere.

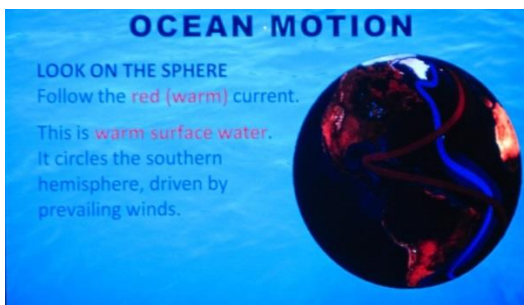
Data sets for the 'Show mode' were standardized for this evaluation, and those same data sets comprised the playlist for the Auto-run mode; those data sets were also provided to the Museum Galaxy Guides, supplemented by a handful of related data sets that gave the Guides more to work with, which was important considering their customized approach in engaging visitor groups. The list of specific data sets for each of these content programs is included in the Appendix.



an image from *See the Seas*



an image from *A Tale of Three Planets*



An example of an image from the supplemental HD video screen. This example shows an image that was coordinated with the *See the Seas* program.

Research Method

To assess the experience of visitors across the three different modes of presentation, one method was needed that would be common to all, and the method selected was a post-SOS-experience interview (i.e., interviewing people after their SOS experience had concluded, but while they were still in the Space Odyssey exhibition area). The procedures were slightly different depending on the mode of presentation:

Auto-run mode: research assistants observed any individual or group of visitors who were looking at the Sphere, and when they observed a visitor group viewing **three or more data sets** in the program, that visitor group was approached when they finished watching, and they were invited over to an interviewing cart directly. They were offered free Planetarium tickets at the end of the interview.

Facilitated mode: When Museum Galaxy Guides interacted with visitor groups, they also used the criterion that a specific visitor group would stay engaged with the Sphere for **at least three data sets**. For any such group, when they were ready to leave, the Guide gave each person in the group an “invitation card” promising free planetarium tickets if they would give their reactions to the Sphere at the nearby interview cart.

Show mode: For visitors who gathered around for a 15-20-minute show, the presenter ended by handing out “invitation cards” and asked adults or families to stop by the nearby interview cart sometime in the next 30 minutes for free Planetarium tickets in appreciation for giving their feedback.

The desired sample size in each of the six conditions was set at 50 visitor groups, seeking a total of 300 interviews; actual sample sizes ranged from 51 to 78 visitor groups in the six conditions, for a total of 378 visitors interviewed.

To avoid misinterpreting which program was running, the two programs (See the Seas, and A Tale of Three Planets) were presented on separate weeks. To avoid misinterpreting the mode of presentation that a visitor group encountered, Shows and Facilitated modes were used on different days; there was no confusion about the Auto-run mode since research assistants personally observed people viewing the Sphere and invited them for a follow-up interview right away.

How to read and interpret the data tables in this report

In visitor studies such as this one, there are two primary types of data: quantitative and qualitative. Tables representing both types are presented in this report, but each is interpreted somewhat differently.

Quantitative data (numbers)

The table below shows an example of quantitative data. As a general rule, the percentages will be presented to the right of the response categories (in this case, the ‘yes’ or ‘no’). Percentages are computed based on column headings (shown above the data), and the figures add to 100% in the columns. The interpretation of the first column of figures is: 91% of the visitors who saw the Auto-run mode of *A Tale of Three Planets* read something on the HD Video screens (referred to as ‘flat screens’ in the actual question to visitors).

Sample QUANTITATIVE data table

Did you read anything on the flat screens behind the sphere?

| | | <i>THREE PLANETS</i> | | | <i>SEE THE SEAS</i> | | |
|-----|----|----------------------|--------------|-------------|---------------------|--------------|-------------|
| | | <u>Auto</u> | <u>Facil</u> | <u>Show</u> | <u>Auto</u> | <u>Facil</u> | <u>Show</u> |
| | | (n=71) | (n=78) | (n=51) | (n=58) | (n=67) | (n=53) |
| | ++ | | | | ** | | |
| yes | | 91% | 82% | 77% | 93% | 55% | 71% |
| no | | <u>9%</u> | <u>18%</u> | <u>23%</u> | <u>7%</u> | <u>45%</u> | <u>29%</u> |
| | | 100% | 100% | 100% | 100% | 100% | 100% |

Asterisks (**) indicate statistically significant differences between columns of figures ($p < .05$). This example shows a comparison of use of the HD video screens (“flat screens”) across the three presentation modes, separately for each program. Statistical significance tests refer to an overall pattern of differences, not just to one or two numbers. In this example, the differences between the three modes of presentation were statistically different for the *See the Seas* program, but not for *A Tale of Three Planets*.

(++) Plus signs are used to indicate patterns of differences which are almost but not quite statistically significant (milder differences, which may have occurred by chance), but which suggest a trend and may have some intuitive value in some circumstances.

How to read the data tables (continued)

Qualitative data (comments from open-ended questions)

The table on this page describes the categories of visitors' answers when asked to give an example of how ocean currents affect climate. As a general rule percentages for open-ended questions will be presented to the left of the response categories (a format that helps distinguish qualitative data, and allows more space to describe the categories). The results are interpreted somewhat differently than tables of quantitative data. The rank order of comments is more important than the specific numbers because visitors could have said anything that they thought of "on the spot," and therefore the possible choices are numerous. In this example, the top answer among viewers of a Show was "Gulf Stream" while the top answer among Auto-run and Facilitated viewers was "I don't know." Another common answer was that the water temperature of the ocean affects weather.

Sample QUALITATIVE data table

Can you give an example of how ocean currents affect climate on parts of the globe?
(people who saw "See the Seas")

| <u>Auto</u> | <u>Facil.</u> | <u>Show</u> | |
|-------------|---------------|-------------|---|
| 7% | 16% | 45% | Gulf Stream, keeps Europe warmer |
| 27% | 7% | 25% | water temperature affects weather (general) |
| 21% | 6% | 0% | El Nino, La Nina |
| 5% | 6% | 13% | acidity, chlorophyll, radiation (not about climate) |
| 12% | 9% | 0% | warm water feeds hurricanes |
| 0% | 0% | 9% | Antarctica stays cold |
| 3% | 4% | 0% | Pacific coast, cold currents |
| 3% | 4% | 0% | polar ice melt, global warming |
| 0% | 3% | 4% | Greenland ice melts, creates colder temperature |
| 3% | 13% | 8% | other / unclear |
| 29% | 31% | 4% | don't know, blank |

Typically, the value of qualitative data such as these is in the analysis of content to open-ended questions, and the results are not compared by statistical tests, for various reasons: e.g., the data are categorical not continuous [which means scores on a scale], and among the options for statistical tests of categorical data an array such as this example would violate the requirements of the comparison because of the many cells with few or no data. If all the data were collapsed into two categories – 'Gulf Stream keeps Europe warmer' as the correct answer, and all others as ancillary answers – a statistical test would indicate a difference between the three modes; however, the value of the descriptive list of categories seems greater than the need for a statistical reduction of the essence of the data.

A. Overall Reactions

This section of the report presents visitors' ratings of the two programs – “See the Seas,” and “A Tale of Three Planets” -- across different modes of presentation. It also includes visitors' recall of memorable images. The key findings are:

- Both program topics (Seas, and Planets) received similarly high ratings overall.
- There was broad appeal across different segments of visitors, e.g., families with children, adults, people who believe climate change is influenced by humans and those who don't, people who have seen SOS before and those who haven't.
- Visitors especially liked the Facilitated mode of presentation.
- People with special knowledge or background in planetary/earth science gave higher ratings to the Auto-run programs compared to those without special knowledge, suggesting that the Auto-run mode is less accessible to the general public.
- The most memorable images from “A Tale of Three Planets” were the volcanoes on Earth and the other two planets. People were surprised about volcanoes on Venus and they liked the guessing game.
- The most memorable images from “See the Seas” were continental drift, ocean temperature and currents, and draining the ocean. People who saw the Japan tsunami wave dataset (Facilitated mode only) recalled that as memorable.

A.1. Ratings of the experience

OVERVIEW: Visitors’ appreciation of SOS programming was positive, with an impressive proportion of visitors (63% and 67%) giving very high ratings to any experience with the Sphere. Results were similar for both programs: “A Tale of Three Planets” or “See the Seas.” Ratings of the Facilitated presentations were the highest – about 80% nines or tens.⁵ Typically in museum visitor studies personal contact with staff or docents is highly valued and that is evident here too. People also enjoyed the Shows and Auto-run programs (63% and 53% average high ratings, respectively).

What rating would you give to your experience at that sphere, on a scale of 1 to 10? (1 means not at all interesting, 10 means extremely interesting)

| | <i>THREE PLANETS</i> | <i>SEE THE SEAS</i> |
|--------------|---------------------------|---------------------------|
| | <u>Overall</u> (n=200) | <u>Overall</u> (n=171) |
| high (9-10) | 63% | 67% |
| medium (7-8) | 34% | 28% |
| low (1-6) | 3% | 5% |

Analyzed by mode:

| | <i>THREE PLANETS</i> | | | <i>SEE THE SEAS</i> | | |
|--------------|-----------------------|------------------------|-----------------------|-----------------------|------------------------|-----------------------|
| | <u>Auto</u> (n=71) | <u>Facil</u> (n=78) | <u>Show</u> (n=51) | <u>Auto</u> (n=51) | <u>Facil</u> (n=67) | <u>Show</u> (n=53) |
| | ** | | | ** | | |
| high (9-10) | 49% | 81% | 59% | 57% | 79% | 66% |
| medium (7-8) | 45% | 19% | 39% | 36% | 18% | 30% |
| low (1-6) | 6% | 0% | 2% | 7% | 3% | 4% |

Note: Tests of statistical significance were conducted on all quantitative data. Statistically significant differences are indicated by asterisks (**), and comparisons that did not quite achieve the criterion of statistical significance are indicated by plus signs (++). When neither of these symbols appears, the differences between columns of data are not statistically significant. More explanation is presented on pages 8-9: “How to read and interpret the data tables in this report.”

⁵ Interpreting visitors’ ratings on 10-point scales is based on years of experience with museum visitors, using follow-up questions to ask what their ratings mean, or why they gave a particular number. Consistently over time and a variety of settings, we have found that ‘9’ or ‘10’ means an excellent experience which is completely positive, a ‘7’ or ‘8’ means a moderately positive rating which can be accompanied by some misgivings or not-so-enthusiastic support, and a ‘6’ or lower number indicates a disappointing experience or one with substantial misgivings. The highest ratings we’ve seen (national award winning, and very popular among visitors) have been in the range of 75%-80% nines and tens.

Ratings of the experience (continued)

OVERVIEW: Additional analyses, on the next three pages, show that ratings were mostly similar among various segments of the audience, e.g., people who believe that climate change is caused by human activity compared to those who don't, families with children compared to adult-only groups, and people who have seen SOS before vs. those who are seeing it for the first time. One significant difference was that people with some special knowledge or background about earth/planetary science rated the Auto-run mode higher than those without special knowledge.

| <u>Analyzed by beliefs⁶ about climate change:</u> | <i>THREE PLANETS</i> | | | <i>SEE THE SEAS</i> | | |
|---|-------------------------|--------------------------|-----------------------|-------------------------|--------------------------|-----------------------|
| | <u>Human</u> (n=107) | <u>Natural</u> (n=46) | <u>Both</u> (n=44) | <u>Human</u> (n=110) | <u>Natural</u> (n=34) | <u>Both</u> (n=40) |
| high (9-10) | 69% | 57% | 59% | 66% | 71% | 65% |
| medium/low (1-8) | 31% | 43% | 41% | 34% | 29% | 35% |

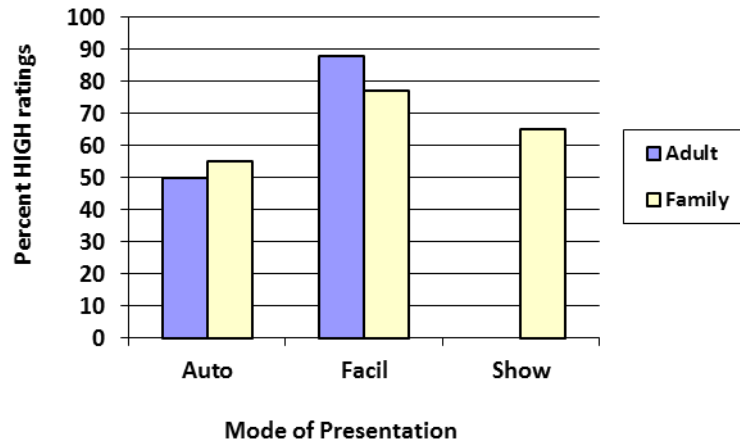
⁶ Visitors were asked which statement best describes their beliefs about climate change: A) the climate is changing, and it is clearly influenced by human activity (HUMAN); B) The climate is changing but it's a natural cycle (NATURAL); C) Climate change is primarily a theory – it isn't really happening (these people are included in the column 'natural' above). Some people wanted to say both 'A' and 'B' so they are represented in the 'BOTH' column above.

Ratings, comparing three presentation modes among various audience segments

Adult-only groups vs. families with kids

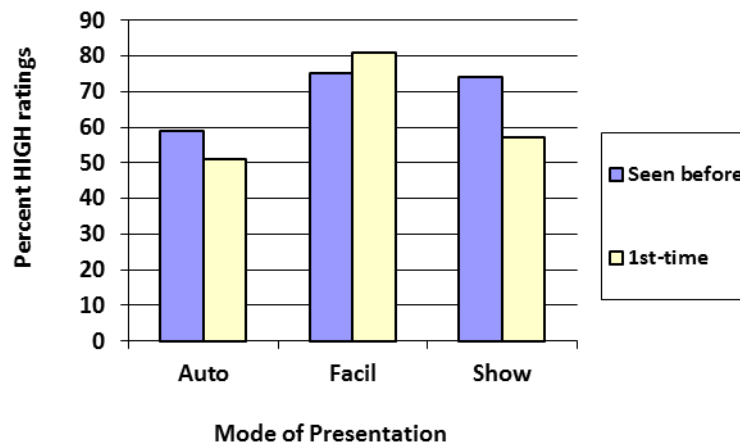
(no statistically significant differences)

(not enough adult-only groups saw a Show for reliable analysis)

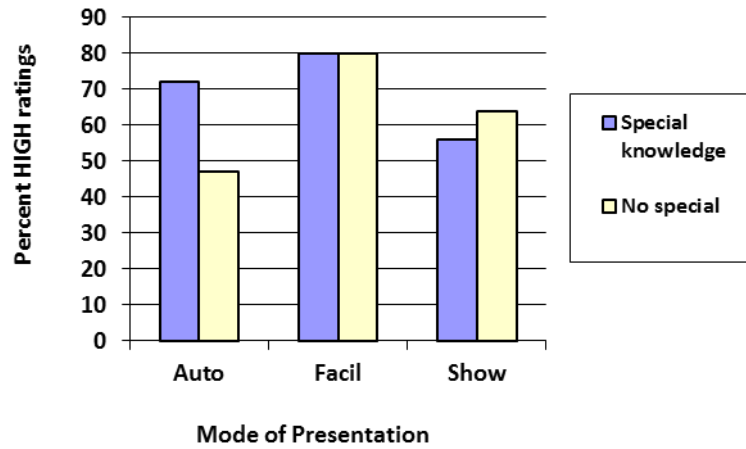


Visitors who have seen SOS before vs. those who haven't

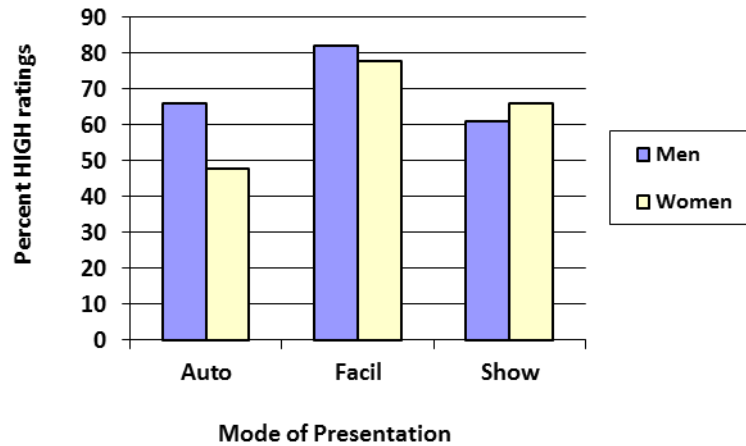
(no statistically significant differences)



People with special knowledge or background in planetary or earth science rated the Auto-run mode higher than those with no special experience ()**



Men rated the Auto-run mode slightly higher than women (borderline difference; p=.06 ++)



A.2. Most memorable features

OVERVIEW: Nearly everyone recalled an image that was memorable in either program. In “A Tale of Three Planets” many people mentioned the volcanoes on Earth, volcanoes on other planets (trying to guess which planet), and visuals of the Earth in general. In “See the Seas” people especially liked the continental drift, draining the ocean, and ocean temperatures/ currents, among others.

Was there any particular visual image that was memorable for you?

| | THREE PLANETS | | | SEE THE SEAS | | |
|-----|-----------------------|------------------------|-----------------------|-----------------------|------------------------|-----------------------|
| | <u>Auto</u> (n=71) | <u>Facil</u> (n=78) | <u>Show</u> (n=51) | <u>Auto</u> (n=58) | <u>Facil</u> (n=67) | <u>Show</u> (n=53) |
| yes | 87% | 90% | 98% | 91% | 90% | 96% |
| no | 13% | 10% | 2% | 9% | 10% | 4% |

Which one? [THREE PLANETS]

| <u>Auto</u> | <u>Facil.</u> | <u>Show</u> | |
|-------------|---------------|-------------|---|
| 17% | 23% | 35% | volcanoes, tectonic plates on Earth |
| 11% | 24% | 18% | volcanoes on the planets, guessing which planet |
| 25% | 8% | 10% | Earth (no detail, probably Blue Marble?) |
| 6% | 15% | 4% | Mars topography, mountains, craters |
| 11% | 5% | 6% | temperatures on different planets |
| 0 | 8% | 14% | Venus (with or without clouds) |
| 11% | 0 | 6% | Earth polar ice cap |
| 7% | 3% | 4% | view of all three planets |
| 4% | 4% | 4% | Earth diurnal temperatures |
| 3% | 3% | 6% | everything |
| 0% | 5% | 0% | other |

Which one? [SEE THE SEAS]

| <u>Auto</u> | <u>Facil.</u> | <u>Show</u> | |
|-------------|---------------|-------------|--|
| 31% | 31% | 25% | continental drift, Pangaea |
| 16% | 18% | 25% | ocean temperatures and currents |
| 21% | 6% | 13% | plate tectonics, sea floor spread |
| ♦ 9% | 7% | 15% | draining the ocean |
| ♦ 7% | 1% | 19% | Mid-Atlantic Ridge, mountains undersea |
| 0% | 24% | 2% | Japanese tsunami / radiation |
| 17% | 3% | 2% | ocean acidification |
| 2% | 0% | 8% | chlorophyll, nutrients |
| 2% | 6% | 2% | other |

♦ These were both from the same dataset but people used different words to describe it, focused on different parts.

Memorable features (continued: “A TALE OF THREE PLANETS”)

Sample of answers: [THREE PLANETS-AUTO-RUN]

Venus night & day, still extreme

Earth with temperature zone and different colors, then Venus & Mars drastically different

The North Pole as it is today and how it has changed

Seeing the volcanoes on each planet because that's what's generating the atmosphere

Space and cloud cover and it turning, makes me feel like this is what astronauts see

Venus, because the colors were bright

The Earth and the polar ice caps, was interesting for the kids to see the planet they live on

Mars and how cold it is

The Earth was beautiful

The Earth, the other two images I'm not sure what they were

Sample of answers: [THREE PLANETS-FACILITATED]

Venus and the volcano activity

Temperature difference and volcanic activity in plates, interesting differences between Mars, Earth, Venus

Photos of Mars & volcanic graphics were both interesting and easy to understand

The volcano placement and how many there were- didn't know there were that many

Difference between day and night on Mars- watch it change

Picture of Earth changing day and night to see the changes in different areas

The Earth, cause that is where we live

The Earth with volcanoes, could relate more than when there is just red dots

Volcanoes and canyon on Mars, interesting that we can know this about Mars

Topographical map of Venus, because you never see it

Sample of answers: [THREE PLANETS - SHOW]

Polar ice cap was pretty scary, wondering about greenhouse effect

Dots of volcanoes, guessing which planet

Earth with clouds on it, looks cool

Interaction of Earth, Mars & Venus because it shows where we are headed and the opportunities to make changes before we ruin earth

Volcanoes, where they are under ocean and on land

The temperature change of Mars from day to night

The images of Earth, they were beautiful and fascinating

Seeing the volcanoes on the different planets

The volcanoes were awesome

The greenhouse effect and showing the polar ice cap

Memorable features (continued: “SEE THE SEAS”)**Sample of answers: [SEE THE SEAS – AUTO-RUN]**

Ridges, trenches in oceans, recently took class in earthquakes and volcanoes
Plates changing over time; gives better sense of how much time we are talking about
Water surface temperature, see difference between equator and poles
One that starts 500 million years ago, plates moving and forming
Ocean temperature & flow, interesting to see how seawater flows
Pangaea, movement of continents, cool to see movement how we got to where we are now
Changes in continents during the years, didn't know it changed that much
Plate tectonics, something I wanted to see in motion
Earth biosphere; love to see where plants transfer and the CO2
Drainage of water from oceans, higher mountains on ocean floor

Sample of answers: [SEE THE SEAS - FACILITATED]

Splitting of continents, how earth developed
Radiation, particles travel across the world
Love seeing earth change over time, didn't know about it previously
The radiation image, I would like to see where nuclear bombs might hit and where the safe zones would be
The Pangaea because it was cool looking
Radiation, seeing the world so small and how it flows around the world in a day or two
When all the continents came together and everything moved
Stream of water, effects on different continents
Radioactivity from Japan, from Philippines and have family there, saw how it impacted them
Shifting of the earth and how it has changed, we forget how continents formed

Sample of answers: [SEE THE SEAS - SHOW]

Mid-Atlantic ridge, never realized size of mountain ridge
Watching plate tectonics and seeing what is underneath
How sea was going from blue to green, shocked how it can go that acidic
Photosynthesis, colors were striking
Tsunami, spreading of sea floor, visualization helps understanding
Where Colorado was, India moved, plates- need to see what happened before us
Draining the oceans and seeing the sea floor, so much that is unexplored
Gulf Stream and weather, interested in weather
The continents dividing- didn't know it before
Currents, keeps countries warm

A.3. Interest in topics

OVERVIEW: Viewers of “See the Seas” programming think ‘climate change’ is the most important theme for future shows. The lowest priority theme was ‘comparing climates of different planets’ – people who have not seen “A Tale of Three Planets” probably do not understand that other planets have climates. As might be expected, there were some differences in priorities based on people’s beliefs about climate change – those who believe that climate change is influenced by human activity gave higher priority to showing ‘climate change’ and ‘recent weather around the globe’ compared to those who don’t believe in climate change (or think it’s a purely natural phenomenon).

Imagine you were creating a new show for the sphere. Would you give high, medium, or low priority to each of these themes? [Asked only of *See the Seas* viewers]

| | <u>High</u> | <u>Medium</u> | <u>Low</u> |
|---|-------------|---------------|------------|
| Climate Change: past, present and future | 80% | 15% | 4% |
| Recent weather around the globe | 70% | 22% | 9% |
| How the atmosphere and oceans affect each other | 62% | 32% | 6% |
| Comparing climates of different planets | 41% | 30% | 28% |

Analyzed by belief ⁷

about climate change:

| Percent ‘high’ priority | <u>Human</u> (n=110) | <u>Natural</u> (n=34) | <u>Both</u> (n=40) |
|---|-------------------------|--------------------------|-----------------------|
| Climate Change: past, present and future | ** 86% | 56% | 88% |
| Recent weather around the globe | ++ 72% | 53% | 78% |
| How the atmosphere and oceans affect each other | 64% | 65% | 58% |
| Comparing climates of different planets | 39% | 38% | 50% |

⁷ Visitors were asked which statement best describes their beliefs about climate change: A) the climate is changing, and it is clearly influenced by human activity (HUMAN); B) The climate is changing but it’s a natural cycle (NATURAL); C) Climate change is primarily a theory – it isn’t really happening (these people are included in the column ‘natural’ above). Some people wanted to say both ‘A’ and ‘B’ so they are represented in the ‘BOTH’ column above.

B. Interpretive Messages

This section analyzes the main messages that visitors got from the two programs. The key findings are:

- The vast majority of visitors (85%+) felt that they understood something better after seeing the SOS program (both topics, regardless of presentation mode).
- The Pangaea visual was most often mentioned as helping people to understand continental drift (“See the Seas”).
- Visitors who saw the Show of “See the Seas” were better able to give an example of how ocean currents affect climate (e.g., the Gulf Stream).
- People who viewed “A Tale of Three Planets” said they best understood the temperature differences of the planets, among other things.
- Visitors who viewed the Show or Facilitated program of “A Tale of Three Planets” were better able to provide an example of how studying other planets tells you something about the climate on Earth (the importance of atmosphere, how Earth’s climate is not so extreme, but it could change in the future).

See the Seas

A Tale of 3 Planets

B.1. Perceptions of messages from “See the Seas”

OVERVIEW: The vast majority of visitors (~85%) said they understood something better from this program, regardless of the mode of presentation. However, they cited somewhat different content depending on which mode they experienced. In the Auto-run mode, people mentioned continental drift, ocean currents/temperature, draining the ocean, and ocean acidification. In the Facilitated mode, visitors mentioned continental drift, ocean currents/temperature, and the Japan tsunami (this last dataset was used only in Facilitated mode). In the Show mode, the top three concepts were continental drift, ocean currents/temperatures, and seafloor spreading.

Is there something you understand better having seen this program?

| | <u>Auto</u> | <u>Facil.</u> | <u>Show</u> |
|-----|-------------|---------------|-------------|
| yes | 85% | 88% | 85% |
| no | 15% | 12% | 15% |

What?

| <u>Auto</u> | <u>Facil.</u> | <u>Show</u> | |
|-------------|---------------|-------------|--|
| 17% | 36% | 30% | continental drift, plate tectonics |
| 17% | 15% | 19% | ocean temperatures and currents, how climate is affected |
| 0% | 13% | 0% | tsunami radiation |
| 14% | 3% | 9% | what’s underneath the ocean, draining the ocean |
| 3% | 3% | 19% | seafloor spread, Mid-Atlantic ridge |
| 7% | 6% | 2% | how the Earth works, global connections |
| 12% | 1% | 4% | ocean acidification, CO2 |
| 0% | 9% | 4% | weather, hurricanes |
| 7% | 1% | 0% | chlorophyll, nutrients |
| 3% | 1% | 2% | climate change, global warming |
| 9% | 9% | 2% | other |

Sample of answers: [SEE THE SEAS - AUTO-RUN]

Good overall scope of how Earth works, world-wide phenomena, interactions
Interesting to see what Earth would look like without any water, like some other planets
Movement of currents in ocean, understand how Britain is so warm
Looking at expanded sea floor, how much of our land is covered by water
Large number of plates
Dust & nutrients
Continental shift
Changing acidity levels because of CO2
How continents came into being
Plant mass and how it huddled continents

Sample of answers: [SEE THE SEAS - FACILITATED]

How air patterns are global
Change of Earth over time
Temperatures of oceans and currents when a hurricane passes over. Warmer oceans increase the power of storms
I never understood the radioactive flow
The Gulf Stream, tectonic plates, Pangaea
Continental plate movement and the placement of Colorado is very interesting
How deep the ocean is
Why earth changed from one big mass to separate continents
See floor is expanding and Ben Franklin discovered Gulf Stream currents
Radioactive contamination

Sample of answers: [SEE THE SEAS - SHOW]

Longest mountain range under ocean
Temperatures and geography
Effect of acid in water
The continental drift
The tectonic plates and how there are mountains underwater
Understanding how the currents affect climate
Shifting of plates in the ocean
How continents moved
Mid Atlantic ridge
Gulf Stream

Perceptions of messages from “See the Seas” (continued)

OVERVIEW: Pursuing a comparative measure of learning across the three presentation modes, all interviews associated with the “See the Seas” program asked a “test question” about how ocean currents affect climate on parts of the globe. People who saw a Show were more able to give a relevant example of this relationship (75% vs. 63% in Auto-run vs. 50% in Facilitated mode). The Gulf Stream was cited frequently. Apparently, the script using datasets about that topic was quite memorable to people (visitors seeing Auto-run or having a Facilitated experience may or may not have seen that particular dataset).

Can you give an example of how ocean currents affect climate on parts of the globe?

| <u>Auto</u> | <u>Facil.</u> | <u>Show</u> | |
|-------------|---------------|-------------|---|
| 7% | 16% | 45% | Gulf Stream, keeps Europe warmer |
| 27% | 7% | 25% | water temperature affects weather (general) |
| 21% | 6% | 0% | El Nino, La Nina |
| 12% | 9% | 0% | warm water feeds hurricanes |
| 0% | 0% | 9% | Antarctica stays cold |
| 3% | 4% | 0% | Pacific coast, cold currents |
| 3% | 4% | 0% | polar ice melt, global warming |
| 0% | 3% | 4% | Greenland ice melts, creates colder temperature |
| 5% | 6% | 13% | acidity, chlorophyll, radiation (not about climate) |
| 3% | 13% | 8% | other / unclear |
| 29% | 31% | 4% | don't know, blank |

Sample of answers: AUTO-RUN

El Nino, La Nina

Cold water comes down from Canada, makes storms over Washington and Idaho

Currents keep it colder in Oregon and Washington than Mexico

Water & air currents circulate causing changes in temperature and seasons

Movement of currents, how Britain is so warm, also El Nino

Carry the heat

Make us warmer or colder, e.g., water off Massachusetts coast is warmer because of currents

Ocean currents affect tropical rainforest, monsoon, ship traffic

Hurricanes

Hotter the ocean current, the hotter the continents

Sample of answers: FACILITATED

Warmer water feeds hurricanes

How tsunami waves reach around the world

El Nino, La Nina is an obvious weather changer

Warm transfers to other areas and makes it more temperate like England

The currents the ocean moves helps replenish and affect weather and food supplies

Gulf Stream and changing of temperature will affect thermal layers of oceans. Polar bears are losing habitats

In South America, temperature of stream affects weather - El Nina

Europe climate is warmer from currents

It can get warmer - like Europe

Warm water goes up to Greenland and comes back cold

Sample of answers: SHOW

Acid levels increase with temperature

Gets warmer in Europe because of Gulf Stream

Currents provide food to different parts of world

Warmer water makes warmer climate

Weather predicting

Warm and cold currents make places livable

Cool and warm water is constantly shifting and moving the warm water affects the species that live there

Watching the temperature travel and warm other places

Ocean currents keep Antarctica cold

Ocean current changes with humidity and climate changes

B.2. Perceptions of messages from “A Tale of Three Planets”

OVERVIEW: Nearly everyone (94%) said they understood something better after seeing “A Tale of Three Planets” and this was consistent across the different modes of presentation. The most salient concept was the temperature differences of the three planets. People also were surprised that there were volcanoes on other planets, and that there were so many volcanoes on Earth. Visitors who saw the Show or a Facilitated presentation were more aware of the atmosphere theme (different atmospheres, how it affects temperature, how volcanoes affect it). Only a small portion of visitors (1% to 4%) spontaneously articulated any specific messages about climate change on Earth.

Is there something you understand better having seen this program?

| | <u>Auto-run</u> | <u>Facilitated</u> | <u>Show</u> |
|-----|-----------------|--------------------|-------------|
| yes | 87% | 97% | 98% |
| no | 13% | 3% | 2% |

What?

| <u>Auto</u> | <u>Facil.</u> | <u>Show</u> | |
|-------------|---------------|-------------|--|
| 31% | 26% | 22% | temperature differences on three planets |
| 20% | 25% | 14% | volcanic activity on the planets |
| 13% | 6% | 12% | comparing planets (in general) |
| 4% | 13% | 14% | clouds/atmosphere on planets |
| 1% | 13% | 8% | how atmosphere affects temperature |
| 6% | 1% | 16% | how volcanoes affect atmosphere |
| 1% | 3% | 4% | climate change / global warming / greenhouse gas |
| 3% | 10% | 0% | Mars (topography, other facts) |
| 1% | 8% | 0% | habitable zone, Earth is just right |
| 1% | 5% | 0% | Earth (other facts) |
| 1% | 1% | 6% | albedo, reflecting sun |
| 1% | 1% | 4% | Venus (other facts) |
| 4% | 9% | 2% | other / unclear |

Sample of answers: AUTO-RUN

*Varying temperatures on planet, how much sunlight is reflected
Never thought to compare Mars Earth & Venus
The temperature of the planets
All the volcanoes on Venus was surprising to me
I did not realize how many volcanoes there are on all the planets
The volcanoes around the world, and how many there are
How volcanoes influence atmosphere
Temperatures of the three planets
I had no idea how many volcanoes were on the planets
Temperatures on the planets and seeing the full rotation of a planet*

Sample of answers: FACILITATED

*Information about atmosphere and temperatures of different planets
It gave me an overall better understanding especially visuals of the planets
How inhospitable Mars & Venus are, did not realize how hot and cold they are
Learned about nature of Venus & habitable planets, why Mars does not have Martians
Lots of things in more depth about all three planets
Temperature on all three planets
The sun and its magnetic fields and pulls
The number of active volcanoes on earth
Difference in size between all three planets
Atmosphere and weather, landmarks, volcanoes*

Sample of answers: SHOW

*Temperature change, especially on Mars, also Venus
Comparing temperature of different planets
Temperatures, atmospheric conditions
Seeing Earth as a planet and how it is like the other planets
The Earth could end up like Mars or Venus if we are not careful
The volcanoes and how they affect the atmosphere
I did not realize the ice was melting so fast
I had no idea there is a word for the amount of light a planet reflects
That we have similar temperatures to the other planets and all the volcanoes
Why the planets are so different*

Perceptions of messages from “A Tale of Three Planets” (continued)

OVERVIEW: As with the other program, a comparative measure of learning was created for “A Tale of Three Planets” across the three presentation modes, using a “test question” about how studying Venus and Mars tells you something about the climate on Earth. The results are impressive across all modes of presentation, but especially for the Show and Facilitated modes. One of the main messages that visitors got from this presentation was about the importance of atmosphere and how it influences temperature on the three planets. People who saw a Show seemed to have a stronger sense of the potential for planetary change over long periods of time, e.g., the Earth has a hospitable climate right now but that could change in the distant future.

Can you give an example of how studying Venus and Mars tells you something about the climate of Earth?

| | ** <u>Auto-run</u> | <u>Facilitated</u> | <u>Show</u> |
|-----|--------------------|--------------------|-------------|
| yes | 78% | 90% | 98% |
| no | 22% | 10% | 2% |

| <u>Auto</u> | <u>Facil.</u> | <u>Show</u> | |
|-------------|---------------|-------------|---|
| 21% | 23% | 18% | how atmosphere traps heat, importance of atmosphere |
| 13% | 15% | 29% | Earth could change in the future |
| 11% | 21% | 20% | Earth is just right, others too extreme |
| 10% | 8% | 10% | different amounts of cloud cover/atmosphere |
| 8% | 10% | 4% | Albedo, sun reflecting |
| 7% | 9% | 4% | temperatures are different |
| 10% | 5% | 4% | planets used to be more similar |
| 4% | 8% | 6% | global warming is happening now, need to fix it |
| 3% | 6% | 2% | effect of volcanic activity |
| 4% | 1% | 2% | Earth has water |
| 4% | 6% | 10% | other / unclear |

Sample of answers: AUTO-RUN

*Watch for global warming, ours getting hotter like theirs, ours optimal distance from sun
So far so good, we haven't hit extremes yet, Venus is so extreme we have a long way to go
To understand what direction we are heading
Because of where the Earth is we have water so we can sustain life
Temperature with cloud cover and without
Possibly what might happen to Earth in the future
Looking at atmospheres of two planets being so different. Tells us how different Earth could
be temperature wise
How much light is absorbed and released and how cloud cover affects temperatures
It gives us an idea of what Earth could look like as we heat up/cool down
The greenhouse effect of the atmosphere and trapping of the gasses*

Sample of answers: FACILITATED

*How atmosphere traps heat
Venus is hotter, Mars cooler, Earth in the middle
That earth can be affected
If change can happen there it can happen here too
Life - Venus too hot and Mars too cold
Gives us an idea of what can occur here in the future
The position of earth and how it affects the habitability of the earth
Forecasts what will happen on Earth
Clouds and energy works to give temperature
Hot core gives protection to Earth*

Sample of answers: SHOW

*More about variants of temperatures
We need to take care of our atmosphere so we don't tip either way
Effect of the sun
Earth is more livable and why
The Earth is in danger of becoming like Venus and Mars - too hot or too cold
Venus was cooler billions of years ago, so changes could also happen on Earth over time
The range of how hot and cold the planets get and how earth might change if we are not
careful
That Earth is in between the two
More atmosphere vs. less atmosphere given the clouds
The Earth still has water but theirs is gone*

B.3. Reading information on the rear flat screens

OVERVIEW: Visitors were most likely to read the information on the flat screens during Auto-run mode (92%), when there is nobody to explain things. However, reading was also high during the Show and Facilitated modes, especially for “A Tale of Three Planets” (probably due to less familiar images). This would suggest that even with staff to explain things, people are looking for help interpreting what they are seeing on the sphere. The lowest amount of reading occurred in the Facilitated mode of “See the Seas” (55%).⁸

Did you read anything on the flat screens behind the sphere?

| | | <i>THREE PLANETS</i> | | | <i>SEE THE SEAS</i> | | |
|-----|----|----------------------|--------------|-------------|---------------------|--------------|-------------|
| | | <u>Auto</u> | <u>Facil</u> | <u>Show</u> | <u>Auto</u> | <u>Facil</u> | <u>Show</u> |
| | | (n=71) | (n=78) | (n=51) | (n=58) | (n=67) | (n=53) |
| | ++ | | | | ** | | |
| yes | | 91% | 82% | 77% | 93% | 55% | 71% |
| no | | 9% | 18% | 23% | 7% | 45% | 29% |

⁸ The proportion who looked at information on the flat screens was 56% in the Baseline Study (DMNS)

C. Understanding Selected Data Visualizations

This section of the report summarizes people's in-depth understanding of selected visuals/concepts from the SOS presentations. The key findings are:

- As a context for interpreting the results it is important to note that visitors who watched a Show clearly saw more images on the sphere (spent more time) than people in the other two modes.
- People who saw a Show displayed a better understanding of several images compared to those who encountered the visualization in the Auto-run or Facilitated mode of presentation.
- People who viewed "See the Seas" felt that ocean acidification was harder to understand than other images (it's a less familiar concept). About 60% of visitors who recalled seeing this image on the sphere could accurately describe it compared to none of those who hadn't seen it.
- The three most easily explained images from "See the Seas" (ocean depth, seafloor spread, sea surface temperature) had legends or keys that may have helped visitors understand what they were seeing.
- In "A Tale of Three Planets" visitors were generally good at identifying images of the Earth (temperature, volcanoes) but not so good at distinguishing the other two planets or their features (Venus and Mars).

C.1. Extent of images seen

OVERVIEW: The amount of time people spent at the sphere was not recorded, but there are two self-report measures that give an indication of extent of use of the exhibit (how many images did you see? and which of the selected photos did you see today?). Visitors who saw the 20 minute Show reported seeing significantly more datasets than people in the other two presentation modes. People who saw “A Tale of Three Planets” reported seeing more images on the sphere compared to those who saw “See the Seas;” and this reflects the reality that there were more datasets in “A Tale of Three Planets.” With respect to recognizing the photo images used in the interview (a subset of the visuals shown on the sphere), there were no significant differences between presentation modes for “A Tale of Three Planets,” but for “See the Seas” the visitors who interacted with Facilitators recognized fewer photos. (Note that the playlist was predetermined for the Show and Auto-run modes, while the facilitators had additional datasets that they could choose to show people instead).

How many different topics or visual images did you see there? ⁹

| | <i>THREE PLANETS</i> | | | <i>SEE THE SEAS</i> | | |
|-------|-----------------------|------------------------|-----------------------|-----------------------|------------------------|-----------------------|
| | <u>Auto</u> (n=71) | <u>Facil</u> (n=78) | <u>Show</u> (n=51) | <u>Auto</u> (n=58) | <u>Facil</u> (n=67) | <u>Show</u> (n=53) |
| | ** | | | ** | | |
| 3-5 | 21% | 28% | 14% | 50% | 58% | 25% |
| 6-10 | 31% | 32% | 6% | 34% | 21% | 45% |
| 11-19 | 18% | 22% | 25% | 3% | 5% | 13% |
| 20+ | 30% | 18% | 55% | 12% | 9% | 17% |

Which of these images did you see on the sphere today?

Number of images recognized ¹⁰

(out of 8 or 9 photos)

| | <i>THREE PLANETS</i> | | | <i>SEE THE SEAS</i> | | |
|-------------|----------------------|-----|-----|---------------------|-----|-----|
| | | | | ** | | |
| one or two | 7% | 17% | 6% | 21% | 43% | 23% |
| three | 27% | 26% | 22% | 29% | 42% | 36% |
| four | 39% | 28% | 35% | 26% | 7% | 15% |
| five | 17% | 19% | 18% | 14% | 6% | 11% |
| six or more | 10% | 10% | 18% | 10% | 2% | 15% |

⁹ The criterion for being approached for an interview during the Auto-run and Facilitated modes was that visitors had to have viewed at least three datasets. “A Tale of Three Planets” had 14 datasets, while “See the Seas” had 8.

¹⁰ Nine photos were used in “A Tale of Three Planets” interviews (6 were actually shown in the Auto-run presentations and Shows; 3 were only used in Facilitated mode). Eight photos were used in “See the Seas” interviews (6 were actually shown in the Auto-run presentation and Shows; 2 were only used by Facilitators).

C.2. Visitors' ability to understand data visualizations (SEE THE SEAS)

OVERVIEW: As an introduction to asking visitors to explain selected images, they were first asked if they recalled seeing them on the sphere. Five of the eight selected images were part of the program playlist, plus there were three alternate (experimental) images (tsunami was only shown in facilitated mode, sea surface temperature had a different color scheme than the version in the program, and plate tectonics was not part of this program).

There were numerous differences between the three presentation modes in terms of which images people recalled seeing. Three images were more recalled in the Show – seafloor spreading, continental drift, plate tectonics. Two images were more recalled from the Auto-run mode – chlorophyll and ocean acidification. These data should be considered as descriptive, yet somewhat unreliable because some visitors (19-38%) said they had seen images that were not part of the presentation they had viewed. For example, plate tectonics seemed like a familiar visual to some people.

Which images did you see? [SEE THE SEAS]

| | <u>Overall</u> | | <u>Auto</u> | <u>Facil</u> | <u>Show</u> |
|--|----------------|----|-------------|--------------|-------------|
| Seafloor spreading | 69% | ** | 69% | 48% | 94% |
| Continental Drift | 67% | ++ | 59% | 65% | 79% |
| Ocean depth, draining | 46% | ++ | 36% | 56% | 45% |
| Chlorophyll | 46% | ** | 72% | 21% | 47% |
| Ocean acidification | 33% | ** | 59% | 14% | 28% |
| <u>(alternate images)</u> | | | | | |
| Japan tsunami (facilitated only) | 25% | | 19% | 33% | 21% |
| Plate tectonics (not seen) | 25% | ** | 22% | 17% | 38% |
| Sea surface temperatures (different color scheme) | 19% | | 24% | 15% | 19% |

Ability to understand data visualizations (SEE THE SEAS continued)

OVERVIEW: Three images were perceived as harder to understand – ocean acidification, sea surface temperatures (because of the unfamiliar color scheme), and Japan tsunami (because fewer people saw it explained in a presentation). When analyzing by whether people recalled seeing an image, ocean acidification is still perceived as hard by 17% of people who saw it and by 64% of those who didn’t recognize it (bottom table). The images that visitors thought were easier to understand, even if they didn’t recall them from the presentation, were draining the ocean, plate tectonics and chlorophyll. Note that these images all show familiar views of the continents and oceans. But, perceived familiarity doesn’t necessarily equal understanding, as the results on the following pages will show.

Considering all of these images, whether you saw them on the sphere or not, which ones are harder to understand than the others?

| | <u>Overall</u> | | <u>Auto</u> | <u>Facil</u> | <u>Show</u> |
|--------------------------|----------------|----|-------------|--------------|-------------|
| Ocean acidification | 49% | ** | 41% | 62% | 40% |
| Sea surface temperatures | 36% | | 40% | 32% | 38% |
| Japan tsunami | 32% | | 34% | 29% | 34% |
| Plate tectonics | 12% | | 12% | 15% | 8% |
| Seafloor spreading | 12% | ++ | 16% | 17% | 4% |
| Chlorophyll | 10% | | 9% | 9% | 11% |
| Continental Drift | 9% | | 5% | 14% | 8% |
| Ocean depth, draining | 6% | | 10% | 3% | 6% |
| said none are hard | 12% | | 7% | 18% | 11% |

HARDER TO UNDERSTAND, analyzed by whether they saw it:

| | <u>Hard, if Saw it</u> | <u>Hard, if Didn't See</u> | |
|--------------------------|----------------------------|--------------------------------|-------------------------|
| Ocean acidification | 17% (59) | 64% (123) | ➔ hardest to understand |
| Sea surface temperatures | 6% (35) | 44% (147) | } not so familiar |
| Japan tsunami | 4% (46) | 42% (136) | |
| Seafloor spreading | 4% (128) | 30% (54) | |
| Continental Drift | 3% (122) | 22% (60) | } most SAY it's easy |
| Ocean depth, draining | 2% (85) | 9% (97) | |
| Chlorophyll | 1% (83) | 15% (99) | |
| Plate tectonics | 0 (47) | 15% (135) | |

(sample sizes in parentheses)

Ability to understand data visualizations from “See the Seas” (continued)

The next sixteen pages present detailed results of people’s understanding of selected images. Visitors were shown eight images during the interview and were asked to describe the meaning of three of them. Note that only a subset of visitors responded to each image so the sample sizes vary and were sometimes insufficient to compute reliable percentages. Some visitors may have recalled seeing the image on the sphere, and some may not have seen it. The answers are analyzed separately based on whether they saw it in the presentation (and therefore should have a better grasp), or didn’t see it.

OCEAN DEPTH

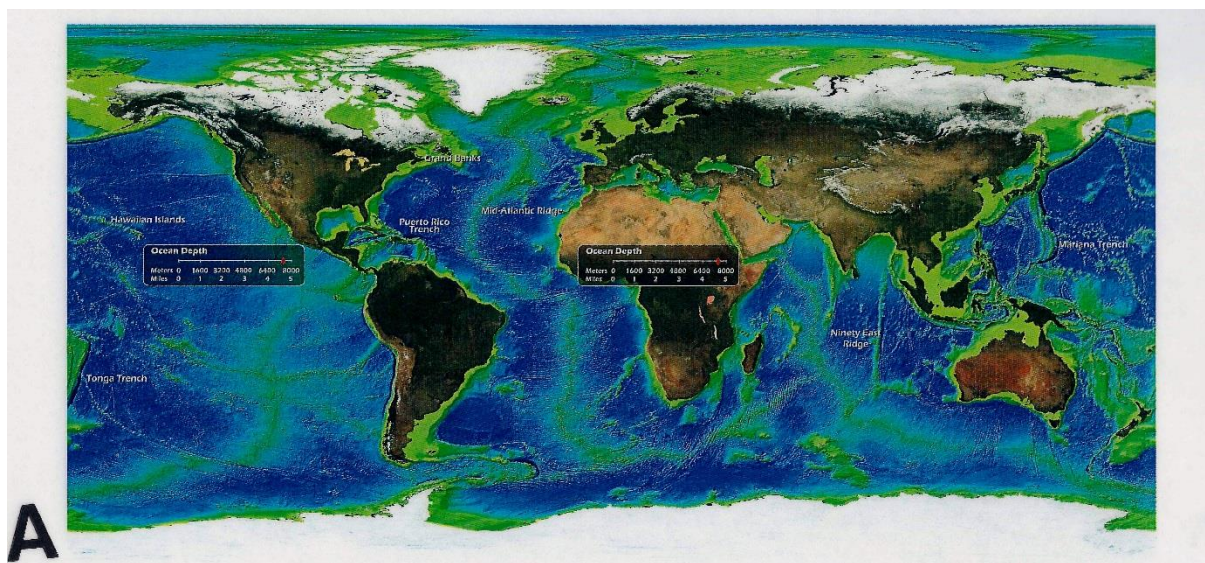
OVERVIEW: The image called ‘ocean depth’ was easily identifiable by the vast majority of visitors (84%) who saw it on the sphere. (They could have read the legend where it said “ocean depth.”)

What does this show you?

(52 visitors were asked this question)

| <u>Saw it</u> (n=38) | <u>Didn’t</u> (n=14) |
|-------------------------|-----------------------------------|
| 84% | ocean depth, topography, trenches |
| 5% | sea floor spread, plates |
| 3% | temperature |
| 8% | other/wrong/don’t know |

Reminder of use:
 36% saw it in AUTO
 56% saw it in FACIL
 45% saw it in SHOW



OCEAN DEPTH / Sample of answers

AUTO-RUN

Ocean depths

Depth of ocean

Ocean depths

Temperature of ocean water

Ocean depth

Ridges in ocean, where they drained it

Maybe ocean levels

Sea floor

Depths of ocean and tectonic shelf plates

Ocean depth, fish population

FACILITATED

Average ocean depth and heat

Ocean depth

It's a wider view to give a wider perspective

Oceans depth

Ocean depth

Ocean depth

Ocean depth and the ridges and trenches

The draining of the water and land under the ocean

The depth of the ocean

I imagine the colors are showing you the depth

SHOW

Depth of oceans

Entire earth today

Plates moving and where trenches are

Depth of ocean when drained

Mountain ranges underwater and ocean depths and how it looks when oceans are down

Depth of ocean and what ocean floor looks like without water

Mountains underwater drained

Ocean depth

Just before he drained the ocean

Shows ocean floor when drained, what lies beneath

Visuals from “See the Seas” SEAFLOOR SPREAD

OVERVIEW: The vast majority of visitors who saw the ‘seafloor spread’ image on the sphere had the right idea about what it shows (83%). People who saw a Show gave more detailed answers and were more likely to mention the factor of time compared to other presentation modes. This image did have a legend, “Age of Oceanic Lithosphere,” that might have helped people explain what they were seeing (although nobody used the term lithosphere in their description).

What does this show you?

(97 visitors were asked this question)

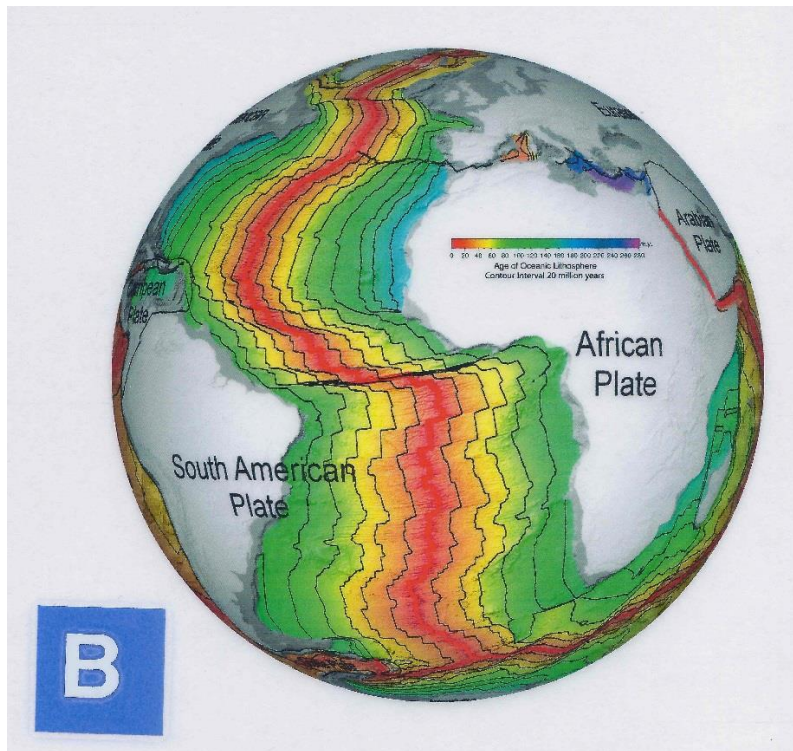
| <u>Saw it</u> (n=81) | <u>Didn't</u> (n=16) |
|-------------------------|--|
| 46% | plate tectonics, plate movement |
| 28% | formation over time, age of sea floor (++ 41% Show vs. 16% other modes) |
| 9% | sea floor spreading |
| 17% | other/wrong/don't know |

Reminder of use:

69% saw it in AUTO
48% saw it in FACIL
94% saw it in SHOW

Who was asked/saw it?

Auto-run: n=25
Facilitated: n=18
Show: n=32



SEAFLOOR SPREAD / Sample of answers

AUTO-RUN

*Plate tectonics, major
Plates under sea
African plates and rifts under ocean floor
Shift in tectonic plates
Line of volcanic activity
Something about plates
Shifting of tectonic plates
Heat, volcanic action
Age of ocean floor
Height of mountains
Age and spread of sea floor*

FACILITATED

*Motion over time of the plates
Different plates
The new sea floors
Ocean level depths
Couldn't recall
Shows the movement
Shows how whole thing flows
Tectonic plates and how they move
The shift in plates
Ring of fire created by plate tectonics*

SHOW

*Ages of land, 20 million years between lines
Age of bottom of ocean, plate formation
How long plates traveled, 20 million years
The ridges and the spreading of the land
Indicates 20 million year intervals
Mountain range and years it took for land to develop and the sea floor
Plates- red was newer
Creation of lava and how it creates mountain ranges, each black line represents 20 million years
Shift in tectonic plates
Temperature variances
The volcanic action of the mountains forming new earth
Rate of expansion of tectonic plates*

Visuals from “See the Seas”
SEA SURFACE TEMPERATURE

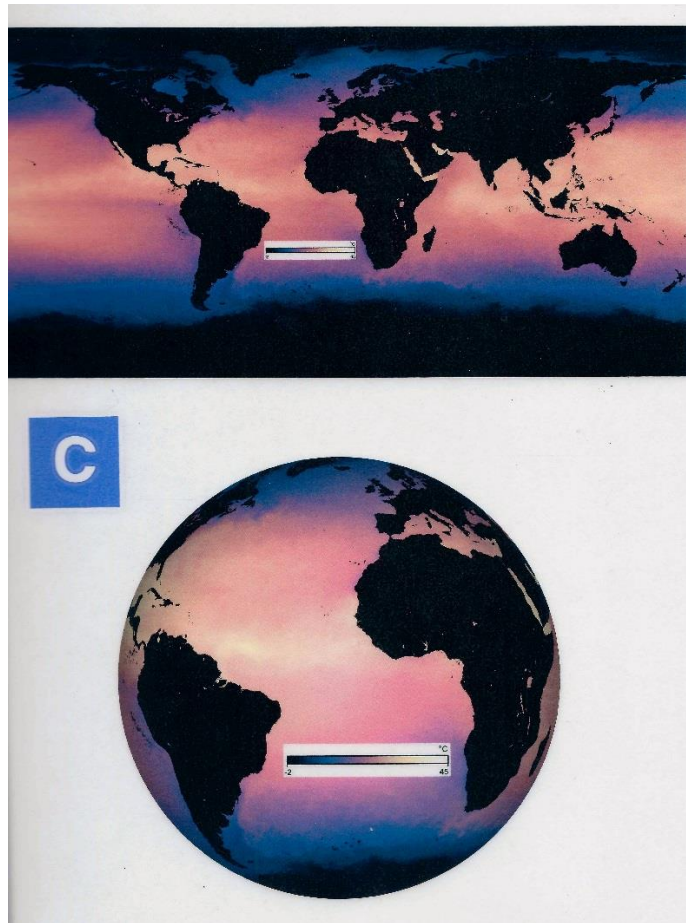
OVERVIEW: This image of sea surface temperature was easily identifiable even though it portrayed different colors than the dataset that was shown in the presentation. Only 19% of visitors recalled seeing this image in the presentation, so the data about understanding come from only people who said they didn’t recall seeing it. And yet, among people who didn’t see it, 86% said that it was about temperature (of course people could have read the legend which shows Celsius so this indicates that visitors are able to read map keys, suggesting that such information could be helpful on the sphere as well).

What does this show you?

(67 visitors were asked this question)

| <u>Saw it</u> (n=17) | <u>Didn’t</u> (n=50) | |
|-------------------------|-------------------------|---|
| | 46% | ocean temperature |
| | 40% | temperature (air, land, or not specified) |
| | 14% | other/wrong/don’t know |

Reminder of use:
 24% saw it in AUTO
 15% saw it in FACIL
 19% saw it in SHOW



SEA SURFACE TEMPERATURE / Sample of answers

AUTO-RUN

Temperature difference in water
Showed temperature
Shows air temp
Water temperature
Where the ocean is getting warmer
Does not look familiar but seems to show temperature
Air or atmosphere
Heat with pink band
Maybe global warming
Different temperatures of oceans

FACILITATED

Temperature of water
Heat
Temperatures from pole to pole
Sunrise
Ocean temperature
I don't understand what it is
That it is at night. Middle is hot, top and bottom are cold
Could be ocean temperature
Ocean temperature
I don't know

SHOW

Ocean temperature
Temperature
How the continents look today, warm near the poles
Temperature of ocean
Heat of ocean and Earth
Temperature and equator
Water temperature
Sea temperature
Temperature of the ocean?
Temperature of water throughout planet
Surface temperatures of water

**Visuals from “See the Seas”
CHLOROPHYLL**

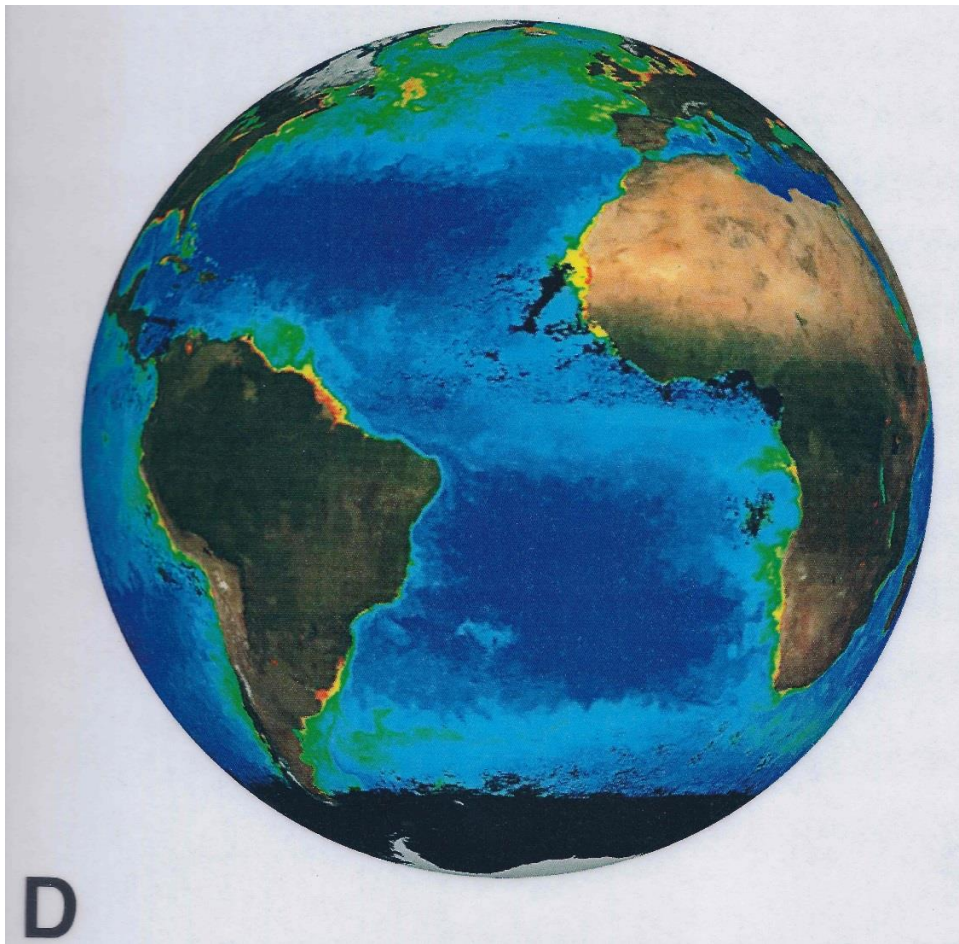
OVERVIEW: Only 29% of visitors identified this image accurately, among those who said they had seen it in a presentation. This image was confused with temperature and depth. There was no legend.

What does this show you?

(42 visitors were asked this question)

| <u>Saw it</u> (n=24) | <u>Didn't</u> (n=18) |
|-------------------------|-------------------------|
| 29% | chlorophyll, nutrients |
| 33% | ocean depth |
| 21% | temperature |
| 17% | other/wrong/don't know |

Reminder of use:
72% saw it in AUTO
21% saw it in FACIL
47% saw it in SHOW



CHLOROPHYLL / Sample of answers

AUTO-RUN

Water disappearing shows land and mountains

Ocean water depths

Change of temperature

Earth and oceans now

Ocean depth

Direction of suns reflection on Earth

I don't know

Warm parts of ocean

Chlorophyll in water

Depths of ocean?

Not sure. Temperature?

Something about continental plates shifting

FACILITATED

Something about temperatures

Ocean depths and continental drifts

I'm guessing currents

Ocean temperature again

The temperature of coastal areas

Heat of the ocean

They changed and separated

Depth of the water

How land fits into each other

Depth of the ocean

Ocean depths

Changes of ocean over time

Ocean depth and nighttime lights

SHOW

Water depths

Talked about nutrient density coming off land masses

Warmer water around land

Chlorophyll in ocean that is affecting the ocean or season

Water depth and spread of continent

Drawing of the water, no the phytoplankton

Chlorophyll and nutrients

Water depth

Shows chlorophyll around the globe

The population of earth

**Visuals from “See the Seas”
PANGAEA, CONTINENTAL DRIFT**

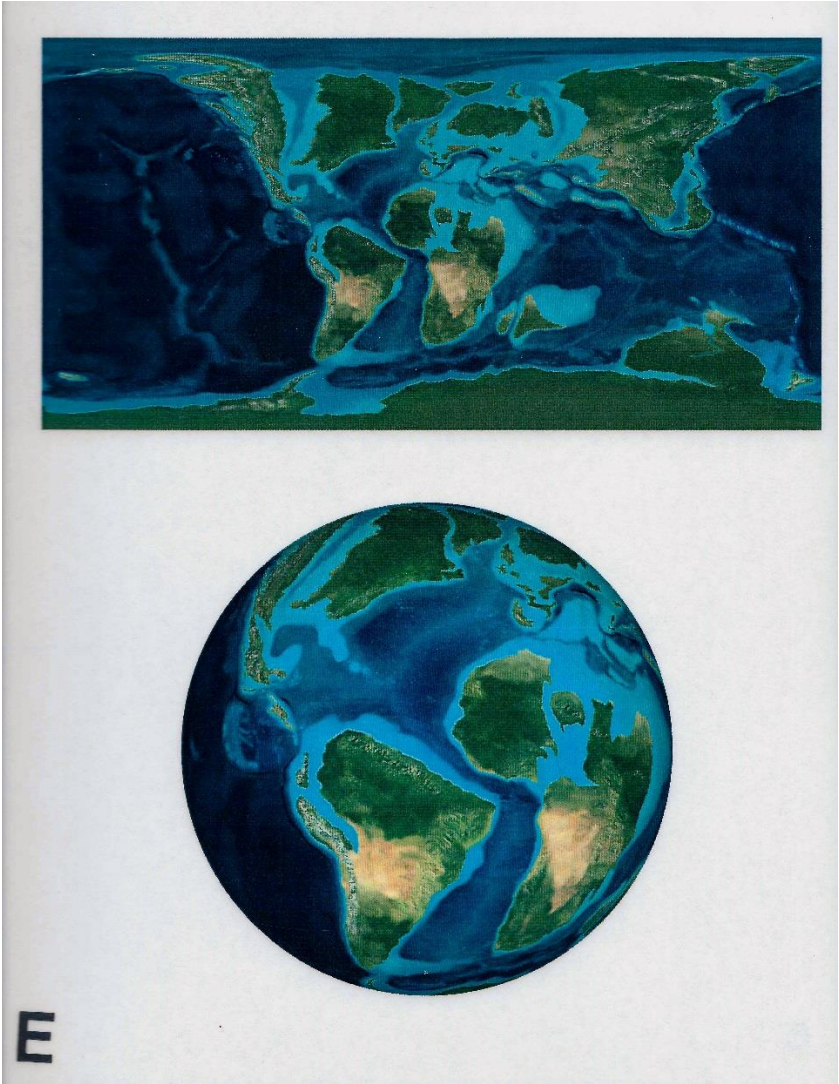
OVERVIEW: A majority of visitors (70%) were able to correctly identify this image if they had seen it in a presentation.

What does this show you?

(79 visitors were asked this question)

| <u>Saw it</u> (n=66) | <u>Didn't</u> (n=13) | |
|-------------------------|-------------------------|----------------------------|
| 70% | | continental drift, Pangaea |
| 18% | | water depth, topography |
| 12% | | other/wrong/don't know |

Reminder of use:
59% saw it in AUTO
65% saw it in FACIL
79% saw it in SHOW



CONTINENTAL DRIFT / Sample of answers

AUTO-RUN

Deserts jump out, green areas, continents moving
How continents/plates moved over eons
Continental drift, Pangaea
Plates moving, forming over time
Continents in past, way they used to be
Continents forming
Ocean depth
Something with continental plate shifting
Separation of the continents
It looks like various depths of the ocean

FACILITATED

Depths
Continents
Formation of continents
Splitting of continents
The shift in the continents as they separated
Ocean depth around different continents
The shift of the continents
Depth of water- darker is deeper, lighter is shallower
Water
The slight of the continents

SHOW

Time lapse video of how continents were shaped
Elevations
Tectonic plates
Rise of rivers and oceans
How continents moved and formed
Drifting of land
Water temperature around land marks
Shows how the planets are shifting
Continental drift
Explaining Pangaea hundred million years ago I think

**Visuals from “See the Seas”
JAPAN TSUNAMI WAVES**

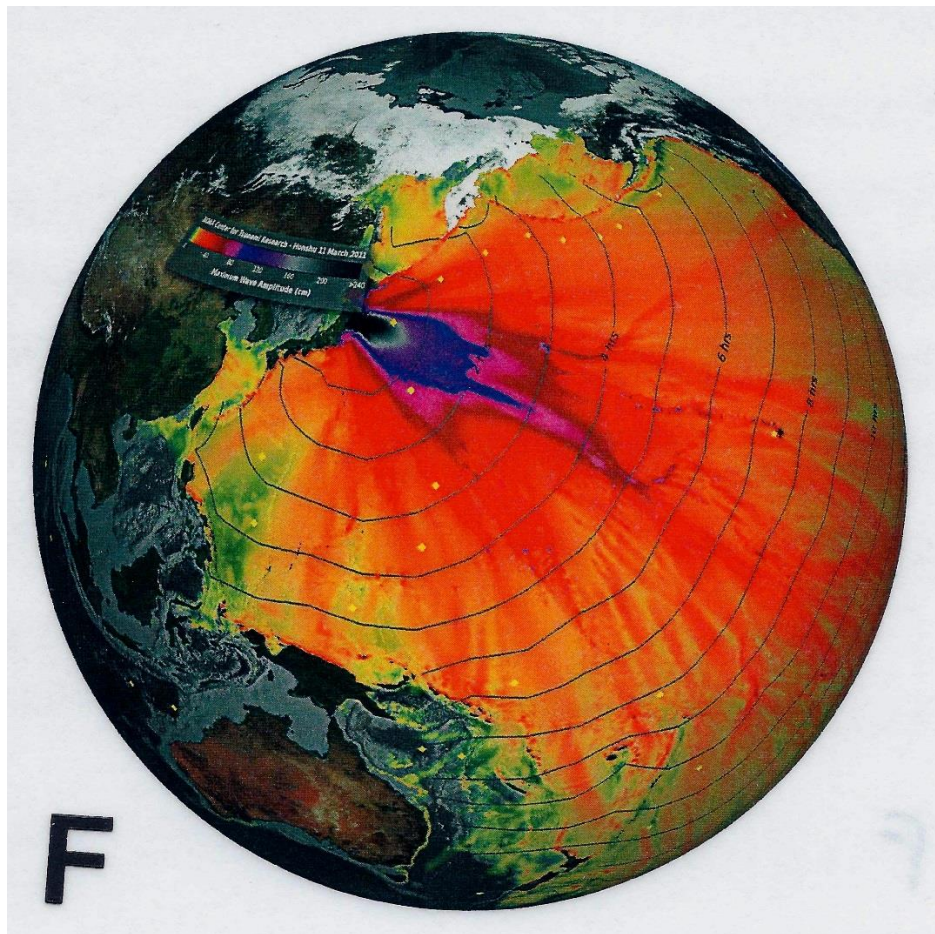
OVERVIEW: About one-third of the people who thought they had seen this image in a presentation correctly identified it as the Japan tsunami waves. Some people thought it was about temperature (because of the bright red, and red tends to mean hot). This image did have a legend that said “maximum wave amplitude,” but the words were very tiny, and apparently people either didn’t read it or it didn’t help them to understand the image.

What does this show you?

(58 visitors were asked this question)

| <u>Saw it</u> (n=22) | <u>Didn't</u> (n=36) | |
|-------------------------|-------------------------|------------------------------|
| 36% | 17% | tsunami waves |
| 9% | 6% | Fukushima radiation |
| 32% | 42% | ocean temperature, red = hot |
| 23% | 36% | other/wrong/don't know |

Reminder of use:
Not shown in AUTO
33% saw it in FACIL
Not shown in SHOW



JAPAN TSUNAMI WAVE / Sample of answers

AUTO-RUN (none would have seen this image in the presentation, unless on a previous visit)

Global warming and temperature changes around the globe

Surface temperature of ocean

Meteor splatter? Tsunami in Japan

Meteorite strike or lava flow

Maybe something to do with temperature

Maybe magnetic field

Maximum wave amplitude [probably read the key]

Inside of Earth coming out

Least amount of ozone cover on the earth

Heat of some kind because it's red

Thermal temperature

Temperature levels

FACILITATED

Tsunami waves as they spread out

I think it shows something hot

An explosion

Tsunami wave

Tsunami time and impact

Radiation spreading across America

Looks like ocean temperature

Fukushima

The temperature around the world

Nuclear meltdown in Japan

Surface temperature

SHOW (none would have seen this image in the presentation, unless on a previous visit)

Temperature of ocean, red means hot, blue means cold

The ocean currents showing hot and cold

Wave amplitude- tsunami [maybe read the key]

Temperature and how it travels around the world

Age of earth

Tsunami

Water temperature

How long to make volcanic explosion

Temperature differences in the ocean?

Warmth of the ocean

Radiation levels after the tsunami

Magnetic field strength maybe

**Visuals from “See the Seas”
OCEAN ACIDIFICATION**

OVERVIEW: Most visitors (61%) were able to identify this image if they had seen it in a presentation. Nobody identified it correctly if they had not seen it on the sphere. This image had no legend.

What does this show you?

(80 visitors were asked this question)

Reminder of use:
59% saw it in AUTO
14% saw it in FACIL
28% saw it in SHOW

| <u>Seen</u> (n=33) | <u>Not</u> (n=47) | |
|-----------------------|----------------------|--|
| 61% | 0% | ocean acidification, pH |
| 6% | 11% | levels of something (chlorophyll, pollution, etc.) |
| 6% | 21% | continents |
| 0% | 19% | ocean depth |
| 27% | 53% | other/wrong/don't know |



OCEAN ACIDIFICATION / Sample of answers

AUTO-RUN

Ocean in motion
Acidity of ocean
Changing acidity levels
Acidity in water
Something about predictive modeling in oceans
Either the acid or the chlorophyll?
Ph of oceans
Acid levels in ocean
Shows how water is becoming acidic over the years
Amount of water versus land
Land, black parts and dots
Change in size/shape of plates
CO2 in ocean changing
Salt content

FACILITATED

Hot spots in the ocean
The acid levels of the ocean water
South America, Africa, Europe
Acidity of the ocean water
Ocean & sandbars
The dots look like they are measuring fluctuations of some sort
Continental shelves
Something about coastal marine activity
Green is water, black is land
Pollution
Shallower area around continents
Continent shelves

SHOW

Where there is photosynthesis or none
Volcanoes that line the oceans
Water emptying out and land becoming more visible
Acidic levels of ocean
Acid
The plate margins of the continents
Continental shelves
Drain the water out
It looks similar to the chlorophyll levels
Water level to expose coast
The dropping of the water and showing the mountain tops
Something to do with light and chlorophyll or maybe mountains underneath ocean
Green ocean and black continents, does not make sense to me

**Visuals from “See the Seas”
PLATE TECTONICS**

OVERVIEW: This image was not in the playlist for “See the Seas” presentations, but most people were able to correctly identify it (74%). This image had no legend.

What does this show you?

(42 visitors were asked this question)

Didn't See

(n=42)

- 74% tectonic plates
- 5% ocean depth
- 10% underwater mountains, ridges
- 11% other/wrong/don't know

Reminder of use:

Nobody saw it on the sphere

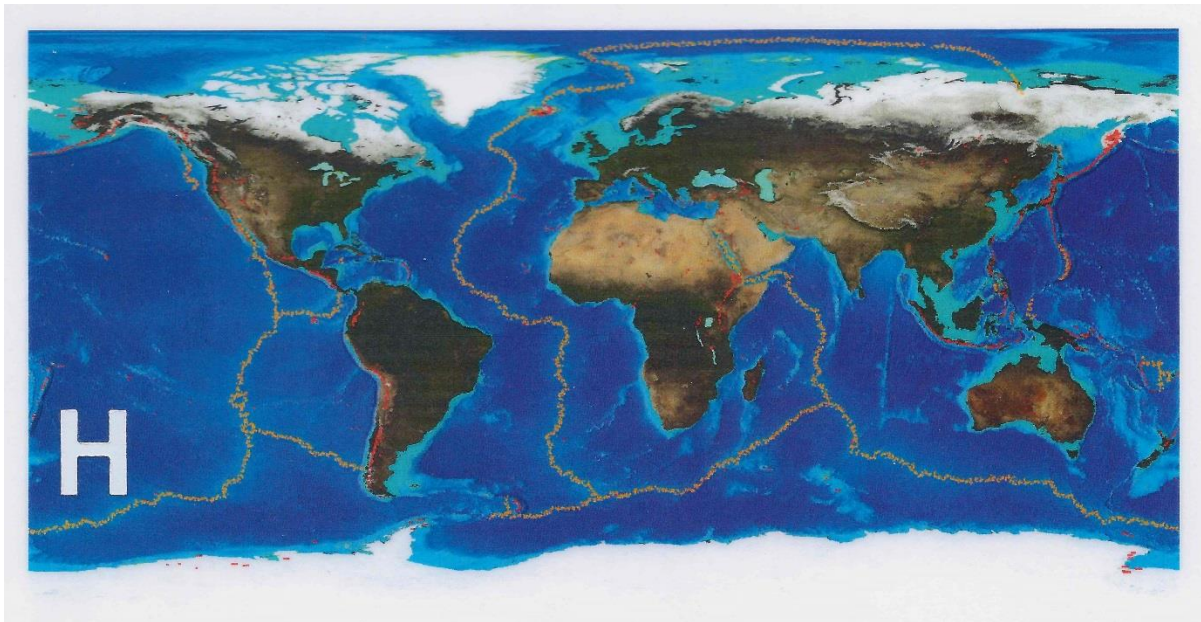


PLATE TECTONICS / Sample of answers

AUTO-RUN

Deep ridges, tectonic plates
Major places where tectonic plates meet or divide
Ocean ridges
Plates of land
Shift in tectonic plates
Tectonic plates and magma
Showing continental divides
Different plates and how they join up together
Lines of the continental plates
Edges of the plates
Where the crust is separating

FACILITATED

Fault line and where plate activity is
Plate tectonics is what it looks like to me
Temperature of Earth
Tectonic plates
Division of fault lines
Plate tectonics and the ice on the poles
Currents
Plates
Water depth or different temperature zones
Separation of plates
Plate boundaries
The fault lines?

SHOW

Water currents
Underwater mountain ranges
The plates
Do not remember
Plate tectonics
Showed the longest mountain range
Current
Plate tectonics
Tectonic plates, the major ones
Plates

C.3. Visitors’ ability to understand data visualizations (THREE PLANETS)

OVERVIEW: As an introduction to asking visitors to explain selected images, they were first asked if they recalled seeing them on the sphere. Six of the nine selected images were part of the program playlist for all three presentation modes, plus there were three alternate (experimental) images that were only available in Facilitated mode.

Most visitors recognized or thought they had seen four of the images in the presentation (all three modes). The least recognized image (that was part of the presentation) was Mars day/night temperatures. It’s unclear why people who saw the Show didn’t recall it because they should have seen it. Two images were most recognized in the Show and Auto-run modes (polar ice cap, Venus volcanoes) and less recalled in Facilitated mode. These data should be considered as descriptive, yet somewhat unreliable because there were recognition errors, e.g., some visitors (~20%) said they had seen Mars MOLA even though that was not part of the Auto-run or Show presentation. (Such errors may be occurring with all images to some extent.)

Which images did you see? [THREE PLANETS]

| | <u>Overall</u> | | <u>Auto</u> | <u>Facil</u> | <u>Show</u> |
|--|----------------|----|-------------|--------------|-------------|
| Earth polar ice cap | 82% | ** | 87% | 70% | 94% |
| Venus volcanoes | 79% | ** | 83% | 65% | 94% |
| Venus clouds/no clouds | 79% | | 75% | 80% | 86% |
| Earth volcanoes | 64% | | 65% | 56% | 74% |
| Earth night temperature | 36% | | 41% | 36% | 31% |
| Mars day/night temp | 14% | | 14% | 14% | 14% |
| <u>(viewed only in Facilitated programs)</u> | | | | | |
| Mars MOLA (greyscale) | 25% | | 21% | 31% | 20% |
| Mars MOLA (color) | 13% | ** | 8% | 21% | 8% |
| Sun | 8% | | 4% | 12% | 6% |

Ability to understand data visualizations (THREE PLANETS continued)

OVERVIEW: Visitors perceived that the sun was a harder image to understand (few people saw this in the presentation). The next hardest images were the colorful Mars MOLA (also not in the presentation) and the Mars Day/Night Temperatures (this was in the presentation but people didn't recognize it for some reason). In general, people view the visuals of Earth, especially the polar ice cap, as easier to understand than other planets. As will be evident later in their descriptions of the photos, some images may seem familiar but people don't really understand them.

Considering all of these images, whether you saw them on the sphere or not, which ones are harder to understand than the others?

| | <u>Overall</u> | | <u>Auto</u> | <u>Facil</u> | <u>Show</u> | |
|--------------------------|----------------|----|-------------|--------------|-------------|----------|
| Sun | 41% | ** | 48% | 27% | 53% | } harder |
| Mars MOLA (colors) | 31% | ++ | 31% | 23% | 43% | |
| Mars day/night temp | 29% | | 27% | 32% | 29% | |
| Mars MOLA (greyscale) | 16% | ** | 21% | 6% | 22% | } easier |
| Venus volcanoes | 14% | | 14% | 18% | 6% | |
| Earth volcanoes | 14% | ** | 13% | 22% | 4% | |
| Earth, night temperature | 11% | | 9% | 8% | 18% | |
| Venus clouds/no clouds | 8% | | 4% | 12% | 6% | |
| Earth polar ice cap | 2% | | 3% | 1% | 0% | |
| said none are hard | 14% | ** | 4% | 28% | 6% | |

HARD TO UNDERSTAND, analyzed by whether they saw it:

| | <u>Hard, if Saw it</u> | <u>Hard, if Didn't See</u> | |
|--------------------------|----------------------------|--------------------------------|-------------------------|
| Sun | n/a (15) | 43% (183) | hardest to understand |
| Mars day/night | 18% (28) | 31% (170) | harder to understand |
| Earth volcanoes | 12% (126) | 18% (72) | easy, to anyone |
| Venus volcanoes | 9% (156) | 31% (42) | understood if explained |
| Mars MOLA (color) | 8% (26) | 34% (172) | understood if explained |
| Earth night temperatures | 6% (72) | 13% (126) | easy, to anyone (♦) |
| Venus clouds/no clouds | 4% (157) | 20% (41) | understood if explained |
| Earth polar ice cap | 1% (163) | 6% (35) | easy, to anyone (♦) |
| Mars MOLA (greyscale) | 0 (49) | 21% (149) | understood if explained |

(sample sizes in parentheses)

♦ familiar images of Earth's oceans and continents may seem easy to understand but that doesn't necessarily mean that people could accurately explain them (see next section of data)

Ability to understand data visualizations (THREE PLANETS continued)

The next eighteen pages present the results of people’s understanding of selected visualizations. Visitors were shown nine images during the interview and were asked to describe the meaning of three of them. Note that only a subset of visitors responded to each image so the sample sizes vary and were sometimes insufficient to compute reliable percentages. Some visitors may have recalled seeing the image on the sphere, and some may not have seen it. The answers are analyzed separately based on whether they saw it in the presentation or not. Note that none of these images had any legends or words to help people understand them.

=====

MARS DAY/NIGHT TEMPERATURE

OVERVIEW: Among people who didn’t recall seeing this visualization on the sphere, very few recognized it as the planet Mars (some didn’t specify which planet and weren’t prompted by interviewers). However, many people (59%) correctly guessed that it showed temperature.

What does this show you? [2 images]

(50 visitors were asked this question)

Reminder of use:
 14% saw it AUTO
 14% saw it FACIL
 14% saw it SHOW

| <u>Saw it</u> (n=11) | <u>Didn't</u> (n=39) | |
|-------------------------|-------------------------|---|
| | 5% | Mars day/night temperature |
| | 3% | Mars (but didn't say temperature) |
| | 28% | temperature (no planet specified) |
| | 13% | day/night temperature (no planet specified or wrong planet) |
| | 10% | temperature (wrong planet) |
| | 10% | named a different planet (Venus, Jupiter, Neptune) |
| | 31% | other / wrong / don't know |



MARS DAY/NIGHT TEMP / Sample of answers

AUTO-RUN

Temperature?

Night and day

The amount of heat on a planet but I don't remember which ones

Shows temperature

The heat differences on a planet, but do not remember which one

Showing heat and climate on one of the planets

Infrared

Temperature day and night

Showing infrared of a planet, probably Uranus

A planet showing temperature

It looks like a temperature representation of a planet, not sure which one

Venus- hot on sun side, cold on back side

Maybe Venus and bad picture of Earth

FACILITATED

He explained atmosphere and gases, this one has more volcanic activity

Temperatures on Jupiter

I saw day & night but you wouldn't know otherwise

Temp variation and dark one is night time

Temperature

A farther away planet

Jupiter

Temperature of Earth

Looks like heat map, dark side of a planet

Temp chart of one of Jupiter's moons

Jupiter?

Temperature for Earth

SHOW

Temperatures on Neptune

Not really, Venus night & day

Temperature

Temperature changes on Venus

Not sure, maybe humidity in ocean

Temperature on a planet

Another planet

Mars showing the day and night

I don't know

The planet Earth at day and night

Mars during day & night

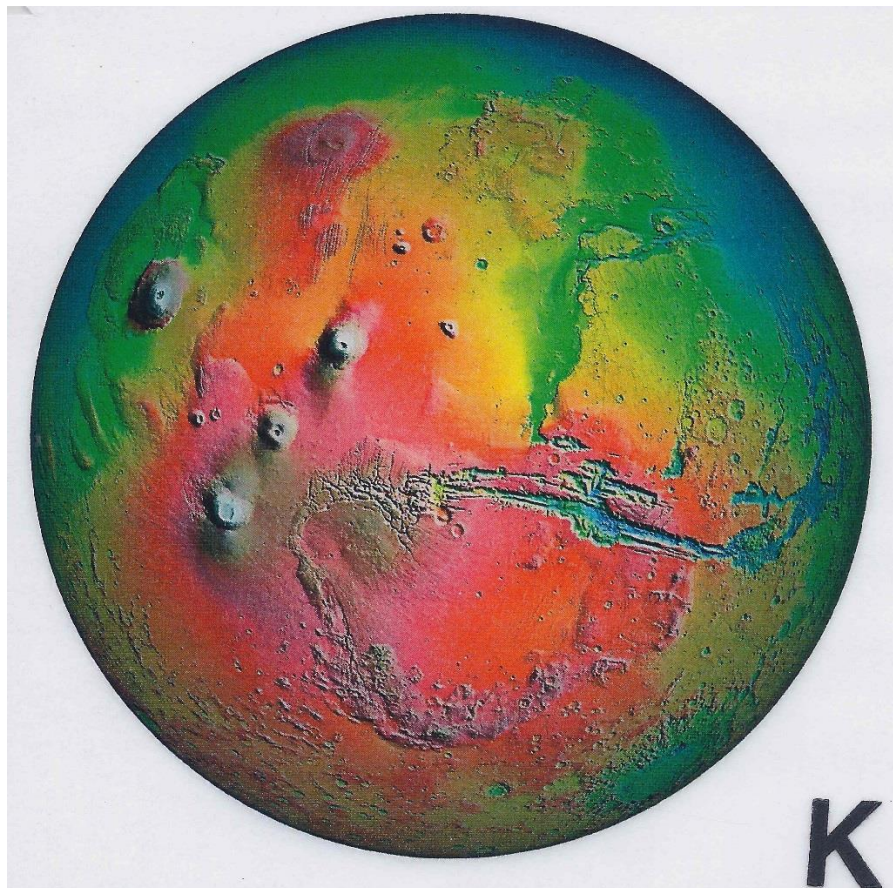
**Visuals from “A Tale of Three Planets”
MARS MOLA – color**

OVERVIEW: Among people who didn’t see this visualization on the sphere, the image was more recognizable as Mars (43% accurately identified the planet), probably because of the topographical features. However, people were most likely to think it showed temperature, probably due to the bright colors. [This image was not part of the Show or Auto-run program, but Facilitators may have used it.]

What does this show you? [1 image]
(38 visitors were asked this question)

| <u>Saw it</u> (n=10) | <u>Didn't</u> (n=28) | |
|-------------------------|-------------------------|---|
| | 25% | Mars temperatures |
| | 18% | Mars |
| | 0% | Mars topography |
| | 36% | temperature (other planet or not specified) |
| | 7% | moon, other planet |
| | 14% | other /wrong/don't know |

Reminder of use:
Not shown in AUTO
21% saw it in FACIL
Not shown in SHOW



MARS MOLA COLOR / Sample of answers

AUTO-RUN

*Mars and something with water
Temperature, color scheme familiar
What does color mean? Shape unfamiliar
Is it the Earth?
Temperature on Mars
Mars? And the temperature
Volcanoes on the surface of a planet?
K and l are the same, I am not sure, maybe different temperatures on Venus?
It shows temperature differences on planets
Temperatures on Venus- side towards sun
Temperature on Mars- infrared photo
Looks like Jupiter*

FACILITATED

*Mars- red higher and blue is lower - blue/green water - red plateau
Mars-altitude changes and volcanoes
Mars as an infrared vision
Mars, temperature, geography
Color coded, displays temperature based on color coding
Looks like Mars but I don't know
Topographic of Mars - he told me what it was
Elevation on Mars
Elevation
Planet
Infrared picture of Mars
Heat of land vs. coolness of water on Earth?
Surface of Mars, possibly with water on it, or temperature*

SHOW

*Moon temperature
Mars, this one is showing the difference in temperature
Temperature on Mars
I think that is Mars but I am not sure what it is showing
Looks like a thermal heat reading of Mars
Showing temperature of some sort on a planet
A picture of Mars
Moon's thermal temperature*

**Visuals from “A Tale of Three Planets”
MARS MOLA – greyscale**

OVERVIEW: This image was correctly identified as Mars by 90% of people who recalled seeing it on the sphere, but by only 22% of those who didn’t see it. About half said it showed topography but some said temperature. The lack of color allows people to focus on the features rather than making incorrect assumptions about temperature, although it also reminds some people of pictures of the moon. [This image was not shown on the sphere as part of the program data sets, but Facilitators may have used it.]

What does this show you? [1 image]

(47 people were asked this question)

Reminder of use:
Not shown in AUTO
31% saw it in FACIL
Not shown in SHOW

| <u>Saw it</u> (n=21) | <u>Didn't</u> (n=26) | |
|-------------------------|-------------------------|---|
| 52% | 11% | Mars topography |
| 38% | 11% | Mars (temperature or other aspect) |
| 10% | 35% | topography, surface of a planet (not specified or not Mars) |
| 0% | 27% | moon |
| 0% | 16% | other /wrong/don't know |



MARS MOLA GRAYSCALE / Sample of answers

AUTO-RUN

Looks like the moon, texture
Channels on Mars
Topo map of Mars
Shows water channels on Mars
Surface of mars or moon
The moon
Topography of Venus or Mars
The moon
The surface of Mars
Mars, at night
Is it the moon?
The moon?
Could be Mars
Mars

FACILITATED

Volcanoes on Mars and how they had active volcanoes- seen in maps from the past
Craters /surface of lunar planets
Gray-scale of Mars
Mars without clouds, craters
Mars, Mt. Olympus and canyons
Mars at night
Mars version of Grand Canyon and volcanoes
It looks like topography of the planet
Mars topography
Mars and its canyons
Night image of moon or Mars
Surface of the planet
Surface of moon

SHOW

Looks like Mars but under a filter
The surface of Mars, because she explained it in the show
Land formation, volcanoes
Mars at nighttime, I think they showed that too
I think that is Mars, too
Radar image of Mars
The surface of the moon, a planet or a rock
The moon and its craters
The moon maybe
Small volcanoes on Mars

**Visuals from “A Tale of Three Planets”
VENUS – CLOUDS/NO CLOUDS**

OVERVIEW: About one-quarter of the visitors correctly identified these two images as Venus with clouds and without clouds. Some people thought it showed two planets, Venus (with clouds) and Mars (without clouds). Those who saw the Show were more likely to recognize the planet as Venus compared to those who saw a different mode of presentation.

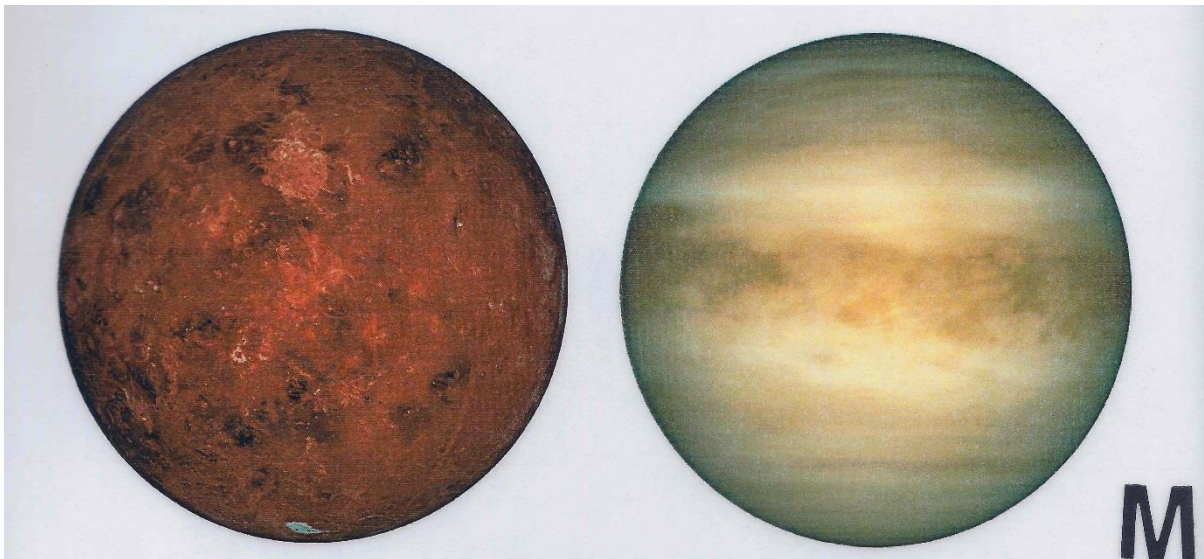
What does this show you? [2 images]

(88 visitors were asked this question)

| <u>Saw it</u> (n=80) | <u>Didn't</u> (n=8) | |
|-------------------------|------------------------|---|
| 26% | | Venus with/without clouds |
| 16% | | Venus |
| <u>4%</u> | | Venus temperatures, day/night |
| 46% | | total who recognized Venus (63% if Show vs. 49% if Facilitated vs. 31% if Auto-run; p=.09) |
| 8% | | atmosphere /clouds on a planet (not Venus) |
| 30% | | Venus and Mars |
| 13% | | other planets, Mars, Saturn, Jupiter |
| 4% | | other / wrong/don't know |

| |
|--|
| <p><u>Reminder of use:</u> 22% saw it in AUTO 17% saw it in FACIL 38% saw it in SHOW</p> |
|--|

| |
|---|
| <p><u>Who was asked/saw it?</u> Auto: n=26 Facil: n=35 Show: n=19</p> |
|---|



VENUS WITH/WITHOUT CLOUDS / Sample of answers

AUTO-RUN

Mars and Venus right? More detail on left
Mars in the day with clouds and without
Different climate/atmosphere on Venus and Mars
Shows Venus and Mars
Mars and Venus
Venus, I remember reading about it
Shows Venus I believe, or is it Jupiter?
Mars and Venus
Mars and Venus
Cloud cover on Mars and Venus
Mars, as a planet
Jupiter, I think I read about that one
Right side is Jupiter, left is Mars or Venus
Probably Venus
Lunar object, one image is gases, other is drier

FACILITATED

Day and night, Mercury?
Clouds on Venus and Venus topography- we saw it and guide told us
Jupiter hurricane and three Earths into that hurricane - familiar with it
Venus with & without cloud covering
Jupiter
Shows temperature on Venus
Atmosphere and actual Venus planet
Venus and Mars- recognizable planets
Jupiter and Mars
Shows beneath cloud cover of Saturn
Cloud cover of Venus, see hotter spots which are darker spots
Atmosphere vs. surface

SHOW

Mars and Venus
I think it shows the albedo on Venus
Venus and Mars
Venus with and without cloud cover
Satellite image of Venus
I recognize those planets
Venus with the clouds and without
The atmosphere of Mars and Venus
The way Venus looks without clouds
Venus
Two different planets

**Visuals from “A Tale of Three Planets”
VENUS VOLCANOES**

OVERVIEW: Most visitors (80%) recognized the image as showing volcanoes, if they saw it on the sphere. About half of the visitors also identified the planet as Venus, although this differed significantly by mode: higher if they saw a Show, lower with the Auto-run program.

What does this show you? [2 images]

(79 visitors were asked this question)

| | |
|---------------|---------------|
| <u>Saw it</u> | <u>Didn't</u> |
| (n=75) | (n=4) |

47%

33%

7%

3%

11%

volcanoes on Venus (77% Show vs. 52% Facilitated vs. 27% Auto-run; **)
volcanoes (other planet or no planet specified)

Mars (no mention of volcanoes)
clouds/atmosphere and surface of planet
other / wrong / don't know

Reminder of use:

83% saw it in AUTO

65% saw it in FACIL

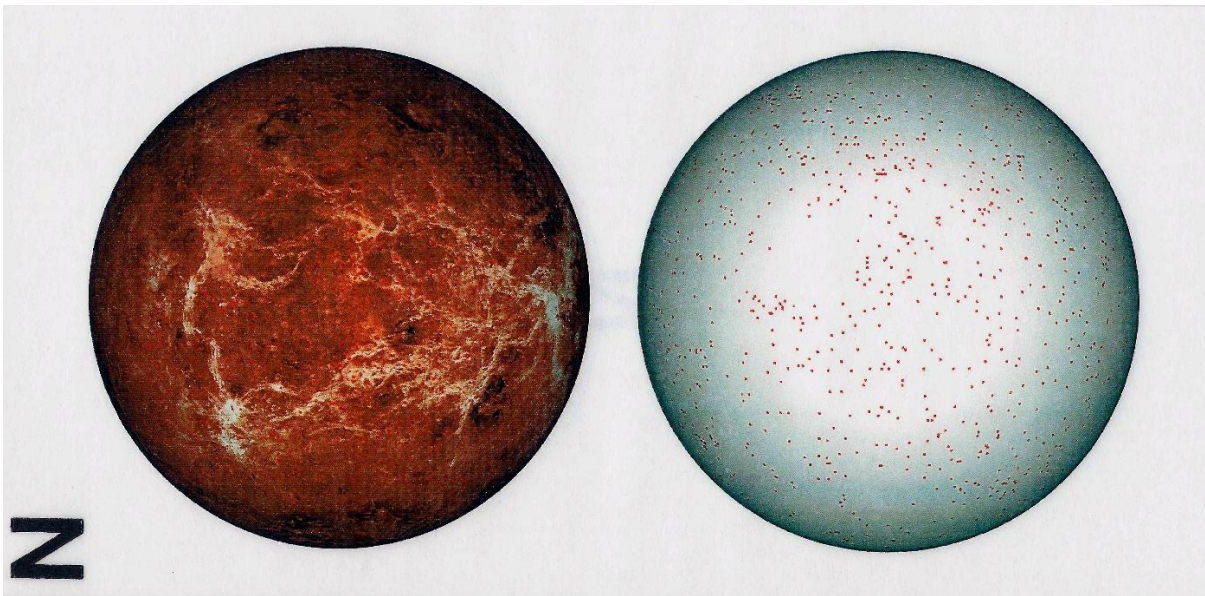
94% saw it in SHOW

Who was asked/saw it?

Auto-run: n=33

Facilitated: n=25

Show: n=17



VENUS VOLCANOES / Sample of answers

AUTO-RUN

*Read screen, it told me location of volcanoes
The locations of the volcanoes on either Mars or Venus
Mars but not sure what red dots were.
The volcanoes we read about on the screen
It's clearly a planet but I'm not sure which one or what the dots show
Volcanoes on Venus
Hot spots- tectonic plates
One of the planets, not sure what red speckles are
The volcanoes of Venus
Shows the volcanoes on one side of the planet
Mars and the volcanoes
Venus - volcanoes
Volcanic activity*

FACILITATED

*Shows volcanic activity on Venus, all over the place
Volcanoes on Venus- guide told me
Venus and its volcanoes
Volcanoes on Mars and mountains
Volcanic activity on Venus
Volcanoes on Venus and overlay of planet- we saw it and was explained
The image of Venus and its volcanoes
Volcanic images of Venus
Shows planet with and without volcanoes
Venus and volcanoes
Probably Venus without clouds, shows heat
Venus, surface under gases*

SHOW

*Volcanoes of Venus and Venus without atmosphere
Mars and its volcanoes
Venus with all the volcanoes, because they talked about it in the show
Either Mars or Venus and the volcanoes
Shows location of volcanoes and bottom is Venus without atmosphere
Venus and the location of the volcanoes
The number of volcanoes on Venus
Volcanoes on Venus they talked about it in the show
Shows volcanoes on mars
Venus and the location of its volcanoes
Venus and where the volcanoes are
The volcanoes on Venus
Volcanic activity on Venus*

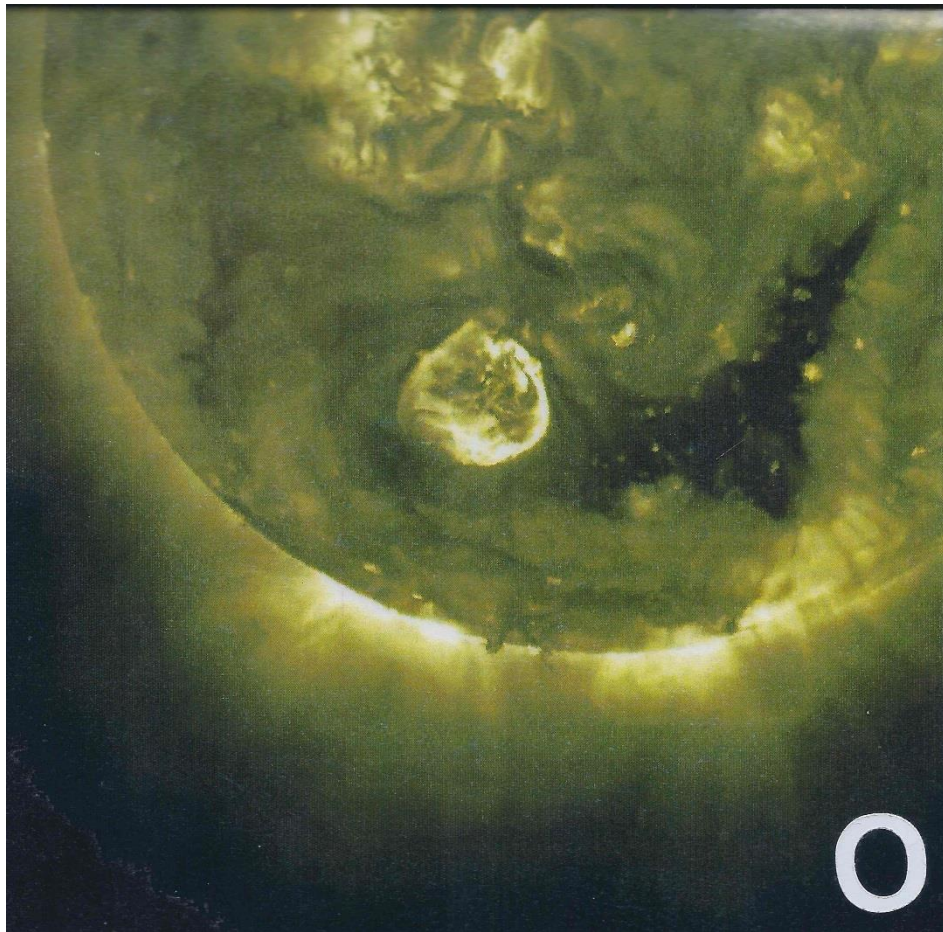
**Visuals from “A Tale of Three Planets”
SUN**

OVERVIEW: Very few visitors saw this image in a presentation, and less than half (44%) correctly identified the sun. Others assumed it was a planet (maybe with the sun’s rays behind it). [This image was not part of the Show or Auto-run presentations but Facilitators may have used it.]

What does this show you? [1 image]
(64 visitors were asked this question)

Reminder of use:
Not shown in AUTO
12% saw it in FACIL
Not shown in SHOW

| <u>Saw it</u> (n=7) | <u>Didn't</u> (n=57) | |
|------------------------|-------------------------|---|
| | 44% | sun |
| | 18% | eclipse of sun, planet with sun behind it |
| | 14% | a planet or moon |
| | 5% | heat/thermal image |
| | 19% | other / wrong/don't know |



SUN / Sample of answers

AUTO-RUN

Sunlight behind, impact of solar flares

Solar flares

Is it Mars at night?

A planet at night, maybe the Sun

The Sun on the opposite side of Mars

The sun?

Shows the sun

Light coming from behind planet

The sun, and the planet is blocking its view

It looks like the Sun but I'm not sure

The surface of a star?

Hot spots on some planet, I'm not sure which

Asteroid or sun/solar flares

FACILITATED

A planet, reflection of sunlight behind it, cloud cover, maybe Venus

I like the way the rays are projecting

Sun spot

Sun, flares, effect on three planets

Sun, solar flares, gas

The Earth with the Sun coming up behind it

The Sun or the Moon

The image of the Moon

An eclipse of the Sun or heat signature

The Sun

Colonial ejections

SHOW

Craters

Sun

No reference, Sun? Planet?

I'm confused about that one, is that the Sun?

Either an exploding star or an eclipse

The Sun?

A planet with the sun behind it

Looks like solar flares

Energy bouncing off a planet

The sun

Sun

Temperature

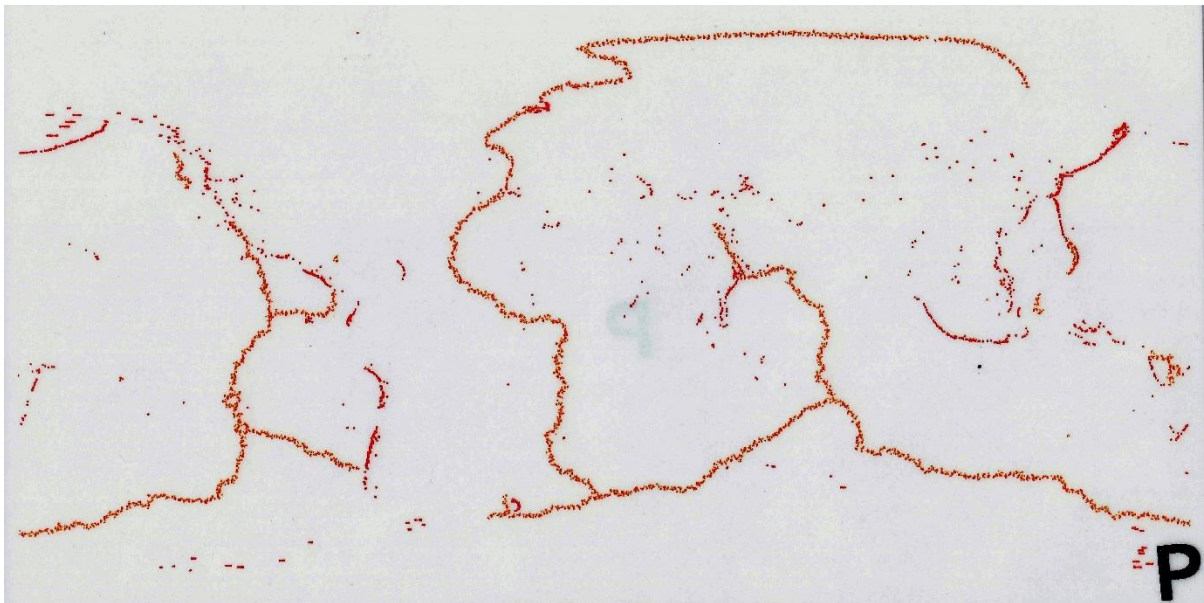
**Visuals from “A Tale of Three Planets”
EARTH VOLCANOES**

OVERVIEW: Nearly everyone who saw this image in a presentation correctly identified it as showing volcanoes. Fewer people specifically named the Earth, but some answers imply Earth (e.g., “volcanoes underwater” or “hot spots on the edge of tectonic plates”), and it seems likely that they recognized the Earth but were not prompted by interviewers to be more specific.

What does this show you? [1 image]
(70 visitors were asked this question)

Reminder of use:
65% saw it in AUTO
56% saw it in FACIL
74% saw it in SHOW

| <u>Saw it</u> (n=62) | <u>Didn't</u> (n=8) |
|-------------------------|--|
| 44% | volcanoes on Earth, fault lines, tectonic plates |
| 45% | volcanoes (didn't say where) |
| 3% | volcanoes on a different planet, Mars |
| 8% | other /wrong/don't know |



EARTH VOLCANOES / Sample of answers

AUTO-RUN

Volcanoes on earth

The line of volcanoes and tectonic plates they described on the screen

The volcanoes that are underwater

This talked about the volcanoes and hot spots on the edge of the tectonic plates

Volcanic activity, tectonic plates

Volcanoes on tectonic plates- simple red on white- easy to see

The underwater volcanoes, because we read about it on the screen

Volcanic map of Mars

Volcanoes on earth

Trenches in oceans

Tectonic plates- volcanic activity

Just red lines, nothing recognizable

Those are edges of tectonic plates and volcanoes, might be earth

FACILITATED

Volcano on earth- dots represent volcanoes and see tectonic plates

Volcanoes and earth- in between all the plates- makes outlines

Volcanoes on earth

Volcanoes, because that's what the guide showed us

Volcanoes on earth, see tectonic plates

Volcanoes and tectonic plates on earth- he told us

Outline of countries-guess, tides and waves

Some form of land

Plate tectonics on earth and outline

Volcanic activity on earth

Plates and volcanic activity and earthquake activity

Ridges on earth

Major faults, volcanic areas

SHOW

Active volcanoes underwater is what I think he said

Active volcanoes they talked about in the show

Shows the volcanoes they talked about in the show

The volcanoes

The volcanoes because they talked about it in the show

Map of different volcanoes on earth

Volcanoes around earth

The location of volcanoes on earth

Volcanoes on earth

Where the volcanoes lie on earth

The earth's volcanoes

Volcanoes but I don't know which planet

**Visuals from “A Tale of Three Planets”
EARTH POLAR ICE**

OVERVIEW: Nearly everyone recognized this image as Earth. Almost half (45%) mentioned the polar ice cap, and this awareness was significantly greater among visitors who saw a Show.

What does this show you?
(79 visitors were asked this question)

| <u>Saw it</u> (n=76) | <u>Didn't</u> (n=3) |
|-------------------------|---|
| 45% | Earth, polar ice cap (67% if Show vs. 41% if Auto-run vs. 25% if Facilitated; **) |
| 45% | Earth |
| 10% | other/wrong/don't know |

Reminder of use:
87% saw it in AUTO
70% saw it in FACIL
94% saw it in a SHOW

Who was asked this question?
Auto-run: n=27
Facilitated: n=28
Show: n=79



EARTH POLAR ICE / Sample of answers

AUTO-RUN

The North Pole and the ice cap
The Earth, because we know what it looks like
Shows the Earth
Reminds me of Earth, continents
Temperature on Earth
Shows change in ice cap on Earth
North end of planet Earth
Darkness absorbs light, makes it colder
Early Earth
Earth and the snow masses
North Pole - top down view of earth
Earth
Earth - North Pole, shrinking ice cap

FACILITATED

It is Earth and most common image
The image of the Earth
Original images of Earth
Polar ice caps
Earth, oceans
Earth, you see ice, oceans, land
Earth temperature - guide put up graph and where it is darker and lighter
Polar ice cap
Earth with no clouds- guide talked about it
Water on Earth- what we are used to seeing
Polar ice cap
Earth
Atmosphere, clouds, poles

SHOW

Earth at night?
That shows the ice cap on the North Pole they talked about
Shows ice cap
The polar ice cap and how much is left
Earth, clouds and the poles
Earth, and the melting of the polar ice caps is what the guide said
Closest to normal globe
Earth with polar ice cap in 2012
Planet earth and the ice caps
Earth
Polar ice cap
Melting of the caps
Polar ice caps

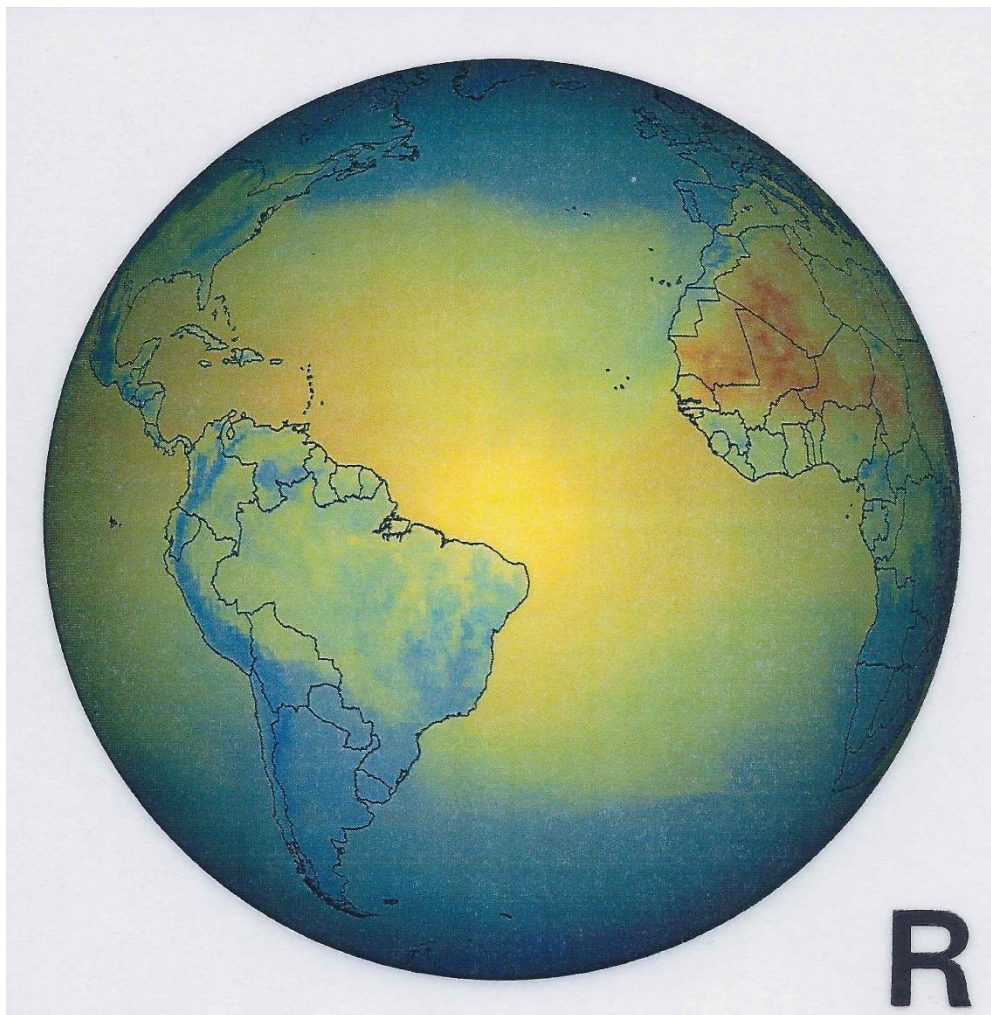
**Visuals from “A Tale of Three Planets”
EARTH NIGHT TEMPERATURE**

OVERVIEW: Nearly everyone who said they had seen this image in a presentation recognized the Earth, and most of those people (73%) correctly said it showed temperatures (but few specified night-time temperatures).

What does this show you? [1 image]
(48 visitors were asked this question)

Reminder of use:
41% saw it in AUTO
36% saw it in FACIL
31% saw it in a SHOW

| <u>Saw it</u> (n=33) | <u>Didn't</u> (n=15) | |
|-------------------------|-------------------------|------------------------------------|
| 64% | | Earth temperatures |
| 9% | | Earth, temperatures at night |
| 21% | | Earth (continents, map, elevation) |
| 6% | | other / wrong/don't know |



EARTH NIGHT TEMPERATURE / Sample of answers

AUTO-RUN

Earth, because you can see the continents

Temperature variations of planets

Different countries

The temperature of Earth

Night time on Earth

It is the Earth

South America and Africa

Earth - thermal variations

No idea

Temperature map at nighttime

Heat/temperature of the region

FACILITATED

It looks like a map

Temperature of the Earth

Earth - not sure about shades of color

Outline of continents- simple visually

Elevation on Earth

Temperature of Earth

Earth temperature, I know Africa is warmer and seeing colors

Earth

Temperature gradient

Water temperature and surface temperature

Thermal image, not sure

SHOW

It helps to understand this is about temperature

Blues colder, yellows warm

Earth at night and its climate

Temperature day/night

Temperature on Earth

Earth and the climate zones, again it was in the show

Earth

Shows temperature change

The pressure on Earth

Temperature

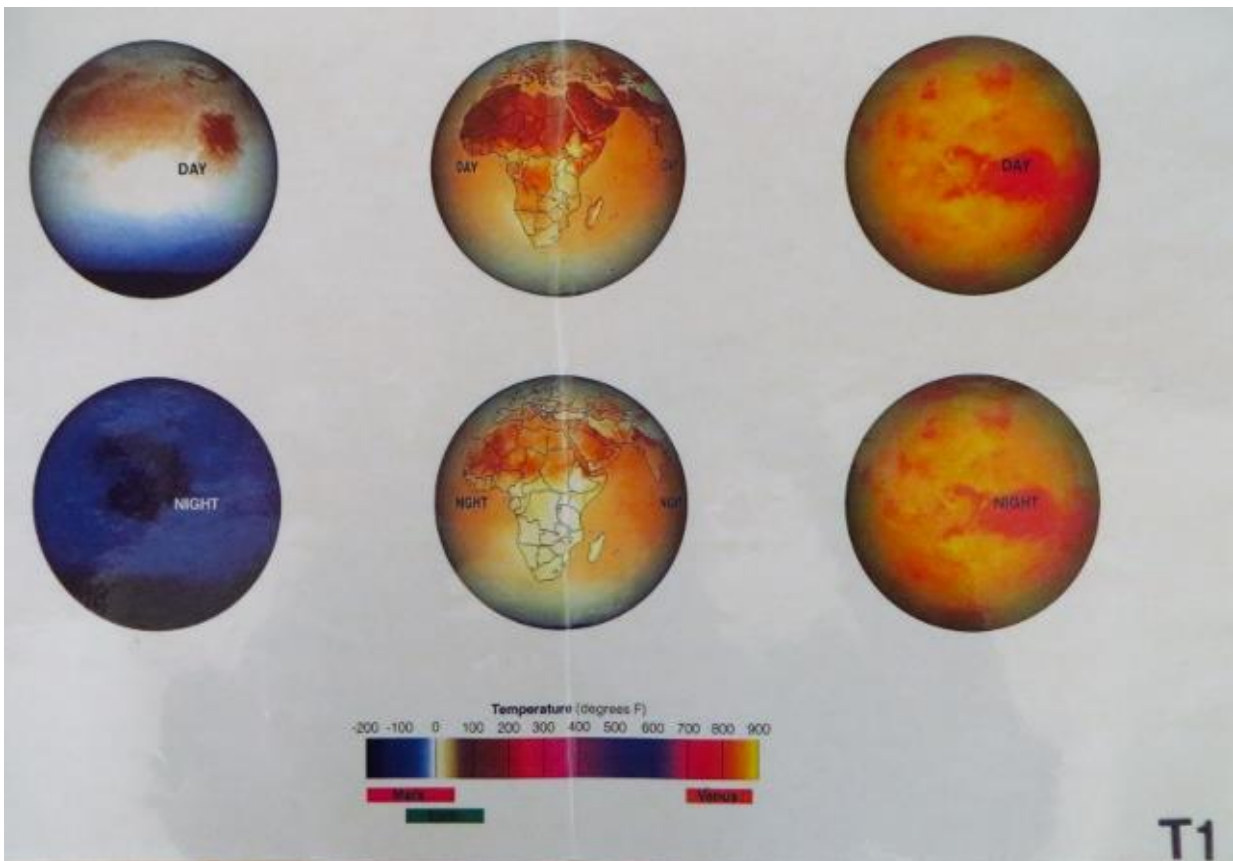
Temperature of Earth

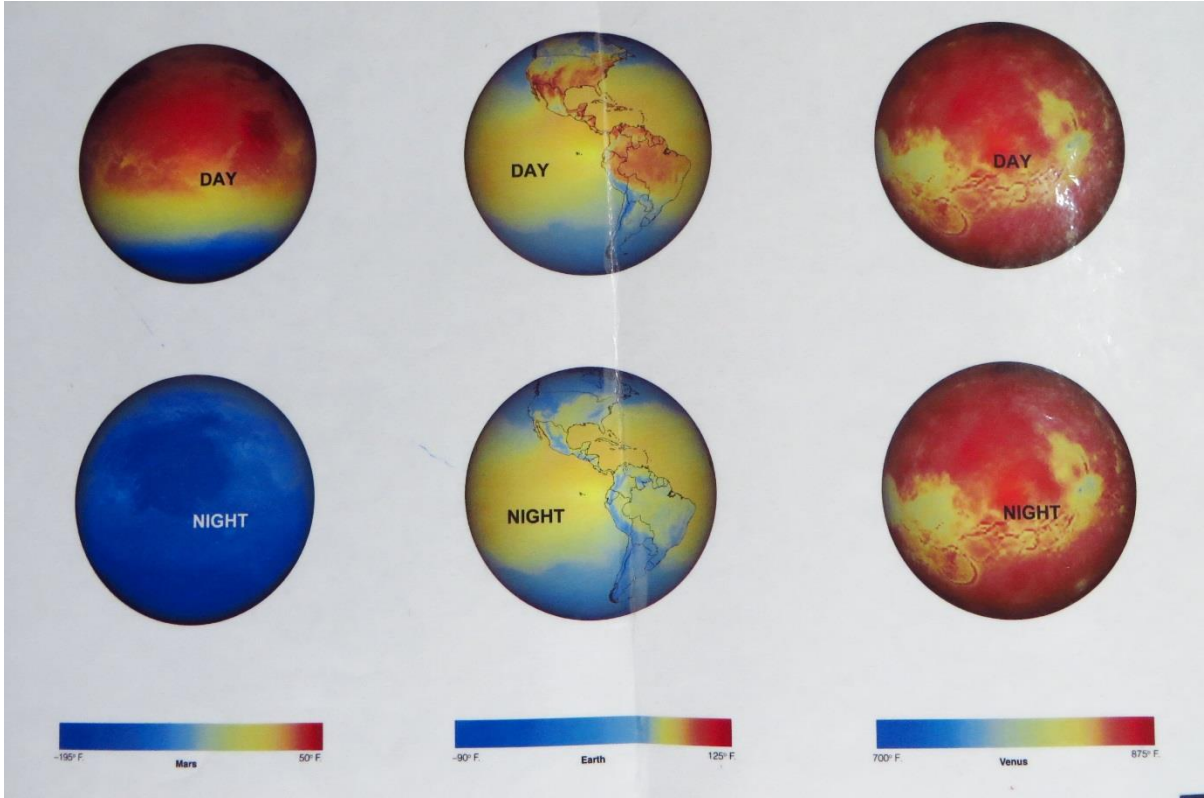
C.4. Perceptions of two methods of showing temperature scales

OVERVIEW: There are options in how to show the huge range of temperatures across the three planets, and visitors' opinions were sought to investigate how they understand this issue. As illustrated below, people were shown a combined scale and three separate scales. Visitors preferred the one combined scale over the three separate scales 60% to 40%. They thought the one combined scale made more sense because it's easier to view quickly, easier to understand, better for comparing, and the other one has too many numbers. Those who preferred three scales said it is better because it's easier to understand, it's more comprehensive, and it shows the temperature variations better.

Does it make more sense to have one combined temperature scale for all planets or three separate scales so each planet gets its own scale?

| | |
|-----------------------|-----|
| one combined scale | 60% |
| three separate scales | 40% |





Why one scale?

Constant among them

It gives you range in one setting to show you the extremes

Easier to understand

Easier to see hotter and cooler planets

It is easier to relate with one scale

Easier to look at just one scale

You can see all 3 together

Because you can see where we fall on the scale, the other graph looks too similar

Since they are trying to show the similarities, I think showing one is easier

Like to have the immediate comparison

Easier to compare planets for temperature, should write names under planets

It makes more sense to have one, it just does

If you are comparing 1 is easier but when I saw it in show it was confusing because there was too much to take in at once

Why three scales?

You can concentrate on each planet individually

I separate things better mentally when I see them visually, individual

Because range is so short, combined one is unclear and has too much variation

Earth had such a small temperature range, would like temps in Celsius

Easier to conceptualize

It just seems clearer to be separate

It shows the variations in temperature better and is easier to understand

It's almost too much information to grasp looking at just one scale

The differences are so large they should be shown individually

It makes more sense that way

It demonstrates the temperature differences in more detail to be separate

More distinct, more subtle color changes

Simply because of the colors and more information

At a glance it is easier to see the difference

Because I think it is easier to explain to the kids

Looks simpler

Cool to see the different temperature places

Seeing different scales for each planet makes it more visually easy

I like seeing them individually

You get to see and observe more when it is separate

Because the variance in temperatures is so wide. One scale is better for people that do not have as much knowledge

To keep it straight so I know which is which

Because temperatures vary the farther you are from the sun and this illustrates that best

D. Characteristics of the Samples of Visitors

This section summarizes the demographic characteristics of the visitors who participated in this study. The key findings are:

- The demographic profiles were mostly similar for the six subsamples representing the two different programs and three modes of presentation.
- One clear exception is that the Show attracted primarily families with children. Facilitators also attracted a higher proportion of families compared to the Auto-run condition, where the sample was about half families and half adult-only groups.
- With that one significant difference, and three other differences with borderline significance, these variations did not undermine the analysis of three different modes of presentation across programs with two different types of content.

Characteristics of the Sample

OVERVIEW: The samples of visitors interviewed after seeing Science On a Sphere were mostly similar across the three modes of presentation in terms of familiarity with DMNS, age, level of education, ethnicity, special knowledge, and beliefs about climate change. One noticeable difference was that the Show clearly attracted more families with children, while adult-only groups were more likely to stop and view the Auto-run program; proportions for guide-Facilitated presentations were in between the other two modes.

| | THREE PLANETS | | | SEE THE SEAS | | |
|---------------------------------|---------------------------|------------------------|-----------------------|---------------------------|------------------------|-----------------------|
| | <u>Auto-run</u> (n=71) | <u>Facil</u> (n=78) | <u>Show</u> (n=51) | <u>Auto-run</u> (n=58) | <u>Facil</u> (n=67) | <u>Show</u> (n=53) |
| <u>Familiarity with Museum:</u> | | | | | | |
| first-time visitors | 39% | 38% | 31% | 40% | 33% | 23% |
| repeat visitors | 61% | 62% | 69% | 60% | 67% | 77% |
| Seen SOS before | ++ 33% | 22% | 16% | 21% | 28% | 36% |
| <u>Residence:</u> | | | | | | |
| Denver | 14% | 18% | 18% | 16% | 12% | 15% |
| other Colorado | 49% | 36% | 53% | 38% | 57% | 58% |
| out-of-state | 37% | 46% | 29% | 47% | 31% | 26% |
| <u>Group Composition:</u> | | | | | | |
| adult-only | ** 45% | 26% | 16% | ** 48% | 34% | 17% |
| family with children | 55% | 74% | 84% | 52% | 66% | 83% |
| <u>Group Size:</u> | | | | | | |
| one | ++ 3% | 1% | 6% | 5% | 3% | 0% |
| two | 38% | 27% | 14% | 33% | 28% | 21% |
| three | 25% | 22% | 22% | 21% | 22% | 38% |
| four | 11% | 23% | 29% | 22% | 22% | 21% |
| five or more | 23% | 26% | 29% | 19% | 25% | 20% |
| <u>Gender:</u> | | | | | | |
| men | ++ 38% | 51% | 32% | 34% | 42% | 45% |
| women | 62% | 49% | 68% | 66% | 58% | 55% |
| <u>Age:</u> | | | | | | |
| 18-29 | 13% | 19% | 16% | 15% | 20% | 6% |
| 30's | 25% | 23% | 31% | 19% | 27% | 24% |
| 40's | 25% | 26% | 26% | 19% | 14% | 40% |
| 50's | 18% | 16% | 14% | 26% | 21% | 11% |
| 60+ | 18% | 16% | 14% | 21% | 18% | 19% |

| | THREE PLANETS | | | SEE THE SEAS | | |
|--------------------------------------|---------------------------|------------------------|-----------------------|---------------------------|------------------------|-----------------------|
| | <u>Auto-run</u> (n=71) | <u>Facil</u> (n=78) | <u>Show</u> (n=51) | <u>Auto-run</u> (n=58) | <u>Facil</u> (n=67) | <u>Show</u> (n=53) |
| <u>Education:</u> | | | | | | |
| high school | 7% | 5% | 10% | 5% | 9% | 2% |
| some college | 22% | 27% | 14% | 14% | 26% | 19% |
| college graduate | 37% | 42% | 51% | 48% | 39% | 43% |
| graduate school | 34% | 26% | 25% | 33% | 26% | 36% |
| <u>Ethnic identity:</u> | | | | | | |
| white | 83% | 77% | 82% | 79% | 72% | 85% |
| other | 17% | 23% | 18% | 21% | 28% | 15% |
| <u>Special knowledge:</u> | | | | | | |
| yes | 21% | 18% | 14% | 29% | 16% | 17% |
| no | 79% | 82% | 86% | 71% | 84% | 83% |
| <u>Beliefs about climate change:</u> | | | | | | |
| due to human activity | 57% | 50% | 57% | 60% | 60% | 62% |
| both human and natural | 18% | 31% | 15% | 19% | 21% | 21% |
| natural cycle | 21% | 14% | 24% | 17% | 15% | 15% |
| disbelief | 4% | 5% | 4% | 4% | 4% | 2% |

APPENDIX:

DATASETS USED IN THE TWO PROGRAMS

| “SEE THE SEAS” Playlist |
|--|
| Draining the Sea (153 Ocean Drain with Land Background) |
| Looking Beneath the Sea (90 ETOPO2: Earth Color Enhanced) |
| Seafloor Spreading (119 Age of the Sea Floor with Shaded Vegetation and 20my contour) |
| Continental Drift (336 DMNS ARC Science Paleanimation with Colorado) |
| Ocean Motion (151 Ocean Conveyor Belts Animation) |
| Sea Surface Temperatures (131 NASA Sea Surface Temperatures) |
| Earth's Biosphere (171 SeaWIFS with Land Background) |
| Acid Ocean (172 Ocean Acidification pH) |
| |
| ADDITIONAL DATASETS FOR FACILITATORS ONLY |
| Seasonal Changes (87 Blue Marble next generation seasonal with topo and bathymetry) |
| Weather (55 Real-Time: Infrared Satellite overland 9Blue Marble gray IR2)) |
| Japan Earthquake 2011 (103 Japan earthquake, March 11, 2011) |
| Japan Tsunami (158 Japan Tsunami Wave Propagation, March 11, 2011) |
| Fukushima Radiation (322 Fukushima Radioactive Aerosol Dispersion) |

| “A TALE OF THREE PLANETS” Playlist |
|---|
| Blue Marble - DMNS Show |
| Venus With Clouds (1) - DMNS Show |
| Mars Base Map - DMNS Show |
| Venus With Clouds (2) - DMNS Show |
| Mars 2nd Base Map - DMNS Show |
| Blue Marble Next Generation Seasonal with Topo - DMNS Show (will probably change--maybe to Global Sea Ice (186 Weekly Sea Ice July 2005 - August 2007 (over EV)) |
| Volcanoes on Venus, Mars, Earth - DMNS Show (layered white with dots/Venus radar map, Mars Base Map, and Earth without Clouds/90ETOPO2:Earth Color Enhanced) |
| Venus with and without Clouds - DMNS Show (layered Venus with clouds/Venus radar map) |
| Mars with and without clouds - DMNS Show (Layered Mars with clouds/Mars Base Map) |
| Earth with and without clouds - DMNS Show (layered Earth with clouds/Earth without clouds) |
| Mars Diurnal Temperatures - DMNS Show (layered day temps/night temps) (will change we hope) |
| Venus Diurnal Temperatures - DMNS Show (layered day temps/night temps) |
| Earth Diurnal Temperatures - DMNS Show (layered day temps/night temps) |
| Earth-Mars-Venus wedges - DMNS Show |
| |
| ADDITIONAL DATASETS FOR FACILITATORS ONLY |
| Jupiter (238 Jupiter (movie)) |
| X-Ray Sun (265 X-Ray Sun) |
| Mars MOLA (MOLA data layered with Mars Base Map) |
| Moon Phases (349 Moon Phases) |