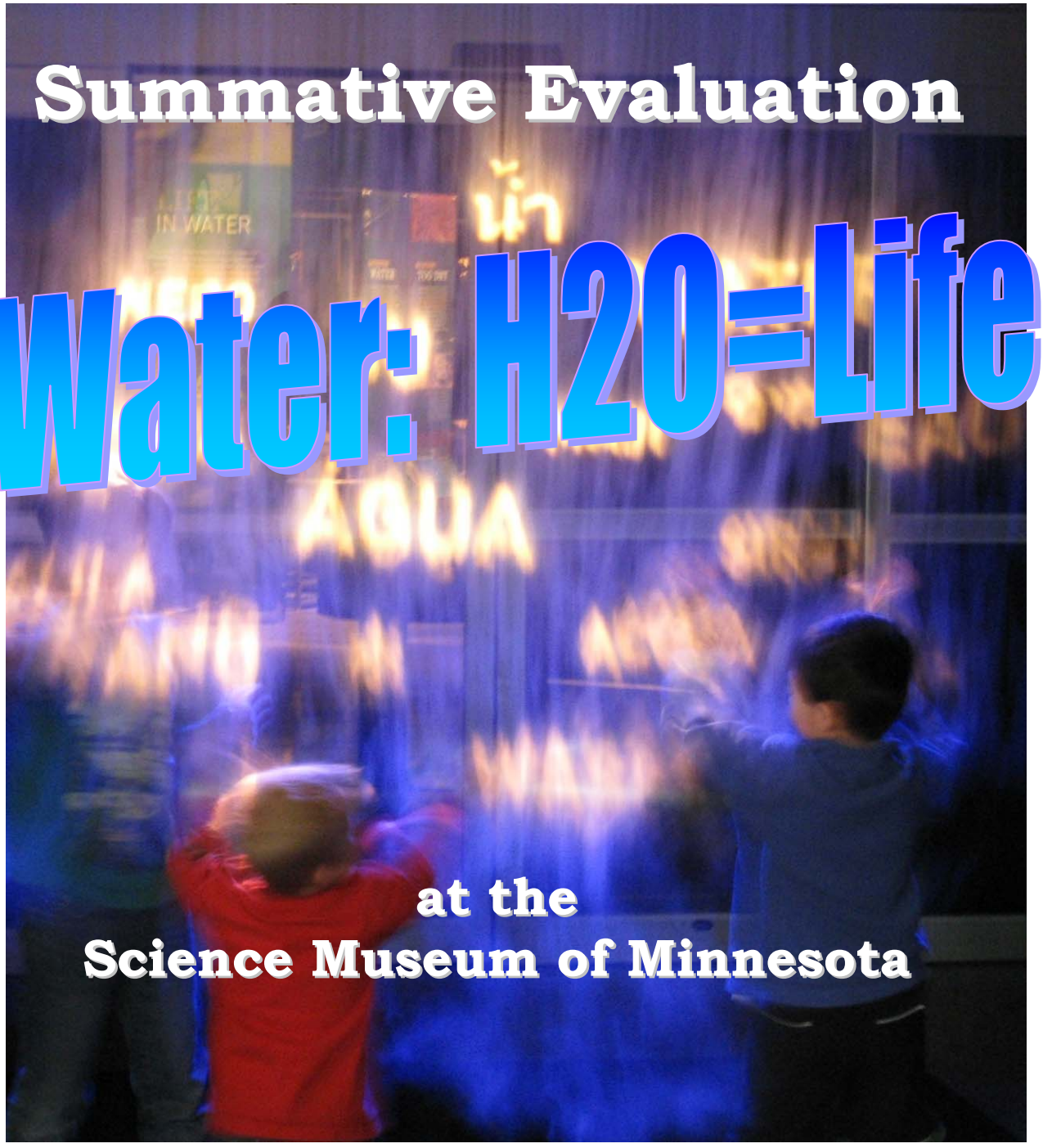
Summative Evaluation



Water: H2O=Life

at the Science Museum of Minnesota

Report prepared by:
People, Places & Design Research

Summative Evaluation of *Water: H_2O=Life*
at the Science Museum of Minnesota

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research report prepared by
Jeff Hayward & Brian Werner
People, Places & Design Research
Northampton, Massachusetts

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Executive Summary

Goal and Method

The purpose of this study was to assess visitors' use and perceptions of several dimensions of visitors' reactions to the 'Water' exhibition as an informal science experience. Visitors were asked about their overall opinions, the highlights, the messages learned and perceptions about recognizing presentations of scientific data, environmental issues and visually memorable exhibits.

SMM staff conducted 399 interviews with visitors as they exited the Water exhibition. In addition, 50 visitors were intercepted at each of four specific exhibits (Rain Table, Science On a Sphere, Three tubes and Geo Wall) and invited to use and give their opinions about those exhibits.

Major Findings

- Overall interest in the Water exhibition was moderate, with interest somewhat higher among older visitors and those with an existing involvement in environmental organizations. In spite of the moderate overall interest, almost all visitors were able to identify exhibits that were "highlights" of the exhibition (especially Science On a Sphere).

- Most visitors were engaged by many of the specific exhibits. After exiting the Water exhibition, visitors were shown 18 images of specific, usually prominent, exhibit areas and asked which they stopped at long enough to figure out what it was about. About four-fifths of these visitors self-reported stopping at seven or more of the 18 exhibits shown in the images. While these exhibits reflected a wide range of attraction, the Dam Interactive, Science On a Sphere, Three States of Water, and Aquifer Interactive apparently attracted a substantial number of visitors.

- Upon exiting, visitors mentioned several things that they learned along these lines: how little fresh water is available, amount of water used in the U.S. and elsewhere, cost and wastefulness of bottled water and the agricultural use of water. When asked which of the 18 images changed how they think about water, four of the five most frequently chosen (Water Bottles, Three Tubes, Agricultural Products and Science On a Sphere) are at least in part about how fresh water is wasted or used inefficiently.

- The exhibition contains many unique visual elements that visitors found memorable. Among the most memorable visuals were Science On a Sphere, Mono Lake, the mist curtain, wall of water bottles, three states of water and the dam interactive. These choices reflect varied types of visual elements that visitors found to be memorable.

- The Water exhibition also helped visitors visualize or understand something about environmental issues. Foremost among these were Water Bottles, Agricultural Products, Three Gorges Dam and the Dam Interactive.

- One objective of the Water exhibition was to present data in a visual manner that visitors would recognize as being based on scientific research. Agricultural Products and the Three Tubes exhibits were most often cited as presenting "data gathered by scientists," but many other exhibits were also mentioned by a substantial proportion of visitors.

Three exhibits were intended to give visitors a unique or novel experience as a way of teaching Earth science visually. These three were technologically sophisticated and presented dynamic visual depictions of water processes. The findings suggest that these exhibits are attractive to visitors and successful in imparting factual information and memorable visualizations.

- **Science On a Sphere:** Visitors who were invited to stop at Science On a Sphere spent an average of five minutes watching the program and reported moderate to high interest. In addition to enjoying the program, most were able to identify something they learned from the program (most frequently that 3% of Earth's water is fresh water and/or 1% of Earth's water is available fresh water). The program included many visual images and visitors found several of them memorable: boxes representing fresh water, the perspective from space, night skies and population. It is worth noting that the most memorable visual image is a relatively spare graphic rather than a realistic image of the Earth. It seems to come as a surprise to visitors.

- **Rain table:** Visitors who were invited to use the Rain table spent an average of two and a half minutes there and gave it mostly moderate to low ratings. Most visitors understood the exhibit to be about the flow of water generally and some caught on to the idea that landforms and contours determine the flow of rainwater. Some visitors gained misconceptions (it's about weather patterns, erosion, snow melt, rivers flow to the South) from the Rain Table. Confusion over the location and "What is this about?" were eliminated after a title and explanatory panel were incorporated halfway through this evaluation.

- **Geo Wall**: Visitors who were invited to use the Geo Wall spent about three minutes watching the program and reported moderate to low interest. Almost all of these visitors were able to give an accurate statement about the content from the program. The 3-D aspect of the program received mixed reviews from visitors: some thought it was better than regular video, some thought it worse and some thought it comparable to regular video. A title panel was added halfway through the data collection period, but it seems to have had no noticeable impact on visitor understanding of this exhibit. While not compelling, this exhibit successfully conveyed accurate information to visitors.

A. Study 1: Overall Reactions to the Exhibit Components

This section reviews people's reactions to the overall exhibition and specific exhibit areas.

Key Findings

- **Overall interest in the exhibition was moderate,** although somewhat higher among some specific types of visitors: older visitors and members of environmental organizations. In spite of this moderate interest, visitors were able to identify something interesting they learned.

- Among the exhibits, **the most popular "highlight" was Science On a Sphere"** but several other 'active' exhibits (mist curtain, Rain Table, three states of water, and dam interactive) were highlights for 10% or more of visitors. Other than the rain table, these were also the exhibits that attracted the most visitors.

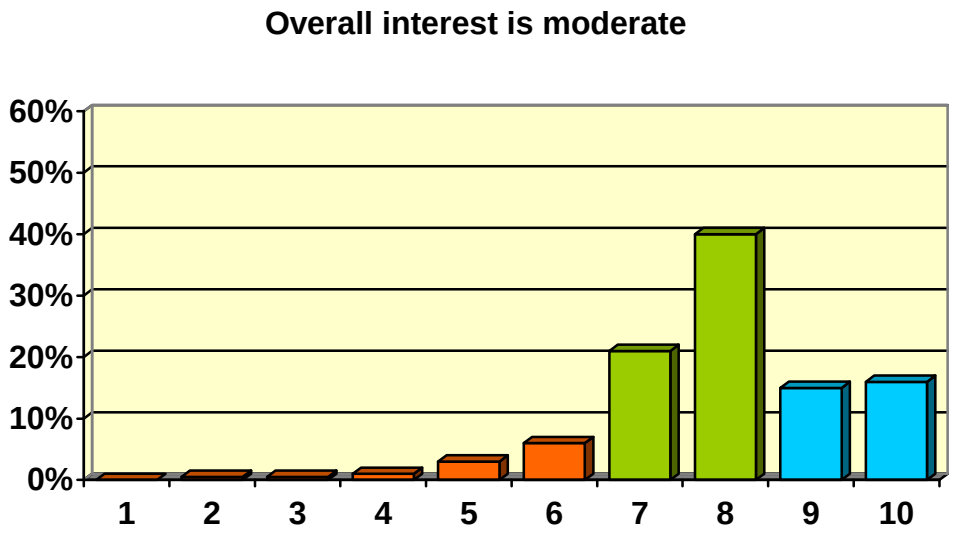
- This exhibition is rich with visually attractive components. For visitors, t**he most memorable visuals were Science On a Sphere, Mono Lake and the mist curtain.**

- Many of the exhibits conveyed information that was common knowledge, seeking to change how people think about water. **Three of the four exhibits visitors most often identified as changing how they think about water concerned use or overuse of water: Water Bottles, Three Tubes, Agricultural Products)**. Water Bottles and Agricultural Products were most likely to help visitors visualize or understand environmental issues.

A.1 Interest in the exhibition

OVERVIEW: As part of the exit interview, visitors were asked to rate the exhibition on a ten point scale. Overall interest in the exhibition is moderate (30% chose 9-10, 60% chose 7-8, 10% chose 1-6) among most visitors.[1] Older visitors (age 55+) expressed moderate to high interest while younger visitors expressed almost uniformly moderate interest. Few people in any age group expressed low interest. Visitors who belong to environmental organizations expressed only slightly higher interest than other visitors. Education does not appear to be correlated with overall interest in this exhibition.

The table on the subsequent pages lists the observations that visitors found most interesting about the exhibition. Many observations were mentioned, but two were more widely cited: how little fresh water is available and the amount of water that people use.



[1] In our experience, a 9-10 rating indicates a high level of interest, whereas 7-8 is a mostly positive evaluation of their experience and 5-6 are polite indications of a lack of interest.

A.1 Interest in the exhibition (continued)

Selected cross-tabulations

rating the experience		age 18-34 (n=142)	age 35-54 (n=203)	age 55+ (n=53)
high	**	19%	34%	45%
medium		67%	58%	53%
low		14%	8%	2%

rating the experience		belongs to environ. org. (n=135)	does not belong (n=262)
high	**	37%	26%
medium		57%	62%
low		6%	12%

rating the experience	not coll. graduate (n=128)	college graduate (n=152)	graduate school (n=116)
high	27%	32%	32%
medium	60%	61%	60%
low	13%	7%	8%

** = indicates statistically significant differences ($p<.05$) between the columns of figures
++ = denotes a trend ($p<.10$) that is not quite statistically significant by the usual standards but may have some intuitive value.

A.1 Interest in the exhibition (continued)

OVERVIEW: The table below lists the observations that visitors found most interesting about the exhibition. Many observations were mentioned, but two were more widely cited: how little fresh water is available and the amount of water that people use.

Tell me something you found out about water that was interesting.

(n=399)	
17%	how little fresh water is available
15%	amount of water used/ comparisons of water use
12%	wastefulness, cost of bottled water
6%	agricultural use of water
6%	number of dams/ effects of dams
4%	how animals adapt of fresh or salt water
3%	about the tufa towers
3%	pollution/ impact of anti-bacterial soaps
3%	declining water tables
2%	states of water/ water cycle
2%	underwater turbines
2%	desalinization is expensive
2%	marshes filter water
2%	about microscopic life in water
2%	about aquifers
2%	charcoal filtration
26%	other (marshes in Iraq, water in Earth's mantle, tap water is as safe as bottled water, invasive species, Great Lakes, impact of drinking saltwater, evaporation)
14%	don't know / no answer

A.2 Highlights

OVERVIEW: Visitors identified a wide variety of "highlights" of the exhibition, but the most frequently mentioned highlight was Science On a Sphere. The mist curtain, Rain Table, three states of water and the dam interactive were all mentioned as highlights by 10% or more of the visitors interviewed.

Can you tell me two highlights of the exhibit?

(n=399)	
33%	Science On a Sphere
13%	mist curtain entrance
12%	Rain Table
12%	three states of water/ ice-water-vapor
10%	dam interactive
9%	Mono Lake/ tufa towers
8%	animals at beginning of exhibit
7%	Three Gorges dam
7%	the interactives
6%	wall of water bottles
6%	3-D movie/ Tucson
6%	computer stations at end of exhibit
5%	polar bear/ arctic exhibit
4%	aquifer/ well crank
4%	videos
4%	having lots of information
3%	playground well
3%	docent cart activities
2%	single drop of water
2%	Three Tubes
2%	Grand Canyon/ rock walls
2%	Catfish/ Mekong Delta
2%	water used for crops and beef
2%	water dripping on porous rocks
2%	water containers, carriers
2%	microscope/ microscopic life
2%	scale about water in human body
2%	computer quiz
1%	purification
1%	marshes
1%	human impact on water
1%	invasive species
1%	quality of exhibit
5%	other specific exhibits
4%	other observations
2%	don't know / no answer

A.3 Individual components: attraction

OVERVIEW: Interviewed as they exited the Water exhibition, visitors were shown 18 images of specific exhibits within the Water Exhibition and asked to identified those that they "stopped long enough to find out what it's about." Self-reported attention to these exhibitions ranged from very high (such as the dam interactive) to very low (the theater components). Out of the 18 images, most visitors recalled stopping at 7-12 places in the exhibition. Visitor groups with younger children (12 or younger) stopped at fewer of the exhibits.

Proportion of visitors who "stopped long enough to find out what it's about"

Dam Interactive	81%
Science On a Sphere	77%
Ice-Water-Vapor	76%
Aquifer Interactive	74%
Animals	66%
Water Bottles	60%
Agricultural Products	59%
Rain Table	56%
Three Tubes	56%
Three Gorges	53%
Underwater Windmill	52%
Wetlands	52%
Playground Pump	47%
Geo Wall	38%
Lifting Water Jug	32%
Home Conservation Computer	27%
Oceans Tsunami Theater	20%
Water Conservation Theater	17%

# places stopped long enough To find out what it's about	all visitors (n=399)	group with children 0-12 (n=224)	group with no children (n=175)
none	1%	1%	1%
1-3	4%	5%	4%
4-6	14%	17%	12%
7-9	28%	32%	23%
10-12	38%	**30%**	**47%**
13-15	14%	14%	13%
16-18	2%	2%	2%

A.3 Individual components: attraction (continued)

OVERVIEW: The tables on the following pages present selected cross-tabulations of visitor demographic variables with their recall of individual components. Many differences were evident among the demographic categories.

As noticed on the previous page, in general groups without children stopped at more exhibits. Groups with children were more likely than other groups to stop at the Rain Table and the Home Conservation Computer stations.

Visitors who belong to an environmental organization were slightly less likely than other visitors to stop at the dam interactive and the 3 stages of water and slightly more likely to stop at the Geo Wall.

For several exhibits, visitors with more education were somewhat more likely to stop than visitors with less than a college degree. Older visitors are also more likely than younger visitors to stop at several of the exhibits.

Selected cross-tabulations

			by: group composition	
stopped long enough to find out what it's about			group with children 0-12 (n=224)	group with no children (n=175)
Rain Table	yes	**	63%	48%
	no		37%	52%
Dam Interactive	yes	**	75%	88%
	no		25%	12%
Three Gorges	yes	++	49%	58%
	no		51%	42%
Water Bottles	yes	**	54%	68%
	no		46%	32%
Underwater Windmills	yes	**	45%	61%
	no		55%	39%
Lifting Water Jug	yes	**	25%	41%
	no		75%	59%
Agricultural Products	yes	**	52%	69%
	no		48%	31%
Home Conservation Computer	yes	**	33%	20%
	no		67%	80%

A.3 Individual components: attraction (continued)

stopped long enough to find out what it's about			**by: org. membership** belong to environ. org. (n=135)	does not belong (n=262)
Dam Interactive	yes	**	75%	84%
	no		25%	16%
Ice-Water-Vapor	yes	**	70%	80%
	no		30%	20%
Geo Wall	yes	**	45%	35%
	no		55%	65%
Water Conservation Theater	yes	++	22%	14%
	no		78%	86%

stopped long enough to find out what it's about			**by: education level** < college education (n=128)	college graduate (n=152)	graduate school (n=116)
Three Gorges	yes	**	41%	55%	**63%**
	no		59%	45%	37%
Water Conservation Theater	yes	**	10%	18%	22%
	no		90%	82%	78%
Playground Pump	yes	**	39%	54%	48%
	no		61%	46%	52%
Lifting Water Jug	yes	**	21%	35%	40%
	no		79%	65%	60%
Agricultural Products	yes	**	53%	58%	**69%**
	no		47%	42%	31%
Home Conservation Computer	yes	**	32%	31%	19%
	no		68%	69%	81%

A.3 Individual components: attraction (continued)

stopped long enough to find out what it's about			**by: age of adult interviewed** age 18-34 (n=142)	age 35-54 (n=203)	age 55+ (n=53)
Three Gorges	yes	**	43%	58%	60%
	no		57%	42%	40%
Water Conservation Theater	yes	**	11%	17%	29%
	no		89%	83%	71%
Wetlands	yes	++	48%	51%	65%
	no		52%	49%	35%
Oceans Tsunami Theater	yes	**	13%	22%	29%
	no		87%	78%	71%
Science On a Sphere	yes	**	70%	78%	87%
	no		30%	22%	13%
Underwater Windmills	yes	**	40%	57%	64%
	no		60%	43%	36%
Geo Wall	yes	**	28%	42%	46%
	no		72%	58%	54%
Home Conservation Theater	yes	**	20%	33%	27%
	no		80%	67%	73%

A.4 Individual components: visual images

OVERVIEW: The water exhibition presents many exhibits with striking visualizations and visitors indicated that many of them were memorable. The most memorable visuals recalled by visitors were the Science On a Sphere, Mono Lake, the entrance, the wall of water bottles, three states of water and the dam interactive. Many other exhibits were recalled by several visitors each.

What two or three visual images will you remember [the Water exhibit] by?

(n=399)	
34%	Science On a Sphere
22%	Mono Lake/ tufa towers
19%	mist curtain entrance
12%	wall of water bottles
12%	three states of water/ ice-water-vapor
11%	dam interactive
8%	animals from beginning of exhibit
8%	Rain Table
8%	polar bear/ arctic exhibit
6%	aquifer/ well crank
6%	Grand Canyon/ rock walls
6%	Catfish/ Mekong Delta
5%	Three Gorges dam
5%	single drop of water
5%	Three Tubes
4%	3-D movie/ Tucson
3%	water containers
3%	marshes
3%	videos
3%	playground well
3%	marshes
3%	purple funnel at end of exhibit
2%	microscope/ microscopic life
2%	scale about water in human body
2%	water used for crops and beef
2%	water dripping on porous rocks
2%	penguin
2%	Mississippi delta floor map
2%	computer stations
1%	purification
8%	other
2%	don't know / no answer

A.5 Individual components: changing thoughts about water

OVERVIEW: Almost all visitors were able to select one or more exhibits that "changed how you think about water." Water bottles and the Three Tubes exhibits were most frequently mentioned, but the underwater windmills and agricultural products were selected by a third or more of the visitors interviewed. The water bottles were more often selected by younger visitors and women (data on next page).

It appears that men were more likely than women to say technological exhibits (rain Table, dam interactive and 3 Gorges Dam) changed their thoughts and women were more likely to select less high tech topics (water bottles, playground pump and oceans tsunami theater).

Which of these would you say changed how you think about water?

exhibit	% selected
Water Bottles	50%
Three Tubes	49%
Underwater Windmills	40%
Agricultural Products	36%
Science On a Sphere	28%
Dam Interactive	27%
Playground Pump	27%
Home Conservation Computer	25%
Three Gorges	24%
Water Conservation Theater	21%
Aquifer Interactive	21%
Lifting Water Jug	21%
Rain Table	16%
Oceans Tsunami Theater	13%
Ice-Water-Vapor	11%
Wetlands	11%
Geo Wall	7%
Animals	4%

A.5 Individual components: changing thoughts about water (continued)

Selected cross-tabulations

changed how I think about water			age 18-34 (n=142)	age 35-54 (n=203)	age 55+ (n=53)
Water Bottles	yes	**	61%	45%	36%
	no		39%	55%	64%
SOS	yes	++	23%	27%	42%
	no		77%	73%	58%

changed how I think about water			belong to environ. org. (n=135)	does not belong (n=262)
Lifting Water Jug	yes	**	7%	29%
	no		93%	71%
Agricultural Products	yes	**	45%	31%
	no		55%	69%

changed how I think about water			men (n=166)	women (n=216)
Rain Table	yes	**	23%	12%
	no		77%	88%
Dam Interactive	yes	**	34%	22%
	no		66%	78%
Three Gorges	yes	**	33%	16%
	no		67%	84%
Water Bottles	yes	**	37%	60%
	no		63%	40%
Oceans Tsunami Theater	yes	**	3%	23%
	no		97%	77%
Playground Pump	yes	**	17%	33%
	no		83%	67%

A.6 Individual components: understanding environmental issues

OVERVIEW: Several of the exhibits enhanced environmental understanding among visitors. The water bottles exhibit was most likely to change visitors' environmental awareness, but agricultural products, Three Gorges and the dam interactive were also mentioned by a third or more of visitors.

Women were more likely than men to say that the playground pump, three tubes and Home Conservation computers helped them understand environmental issues.

Which of these helped you visualize or understand something about environmental issues related to water?

exhibit	% selected
Water Bottles	58%
Agricultural Products	44%
Three Gorges	41%
Dam Interactive	36%
Three Tubes	30%
Water Conservation Theater	30%
Underwater Windmills	26%
Home Conservation Computer	25%
Wetlands	25%
Science On a Sphere	22%
Aquifer Interactive	20%
Playground Pump	19%
Oceans Tsunami Theater	19%
Geo Wall	16%
Rain Table	15%
Animals	8%
Lifting Water Jug	7%
Ice-Water-Vapor	5%

A.6 Individual components: understanding environmental issues (continued)

Selected cross-tabulations

helped visualize or understand environmental issues			men (n=166)	women (n=216)
Playground Pump	yes	**	11%	23%
	no		89%	77%
Three Tubes	yes	**	22%	35%
	no		78%	65%
Home Conservation Computer	yes	**	13%	29%
	no		87%	71%

helped visualize or understand environmental issues			belong to environ. org. (n=135)	does not belong (n=262)
Three Tubes	yes	**	42%	23%
	no		58%	77%

helped visualize or understand environmental issues			age 18-34 (n=142)	age 35-54 (n=203)	age 55+ (n=53)
Geo Wall	yes	**	5%	16%	33%
	no		95%	84%	67%

A.7 Individual components: recognizing data

OVERVIEW: Visitors were also asked if they recognized exhibits that presented "data gathered by scientists." Almost all the visitors were able to select one or more exhibits they thought presented data. The two that stood out the most were the Agricultural Products and the Three Tubes, but many other exhibits were also selected.

Compared with older visitors, younger adult visitors were more likely to recognize data in the animals and Geo Wall exhibits.

Which of these would you say present data gathered by scientists?

exhibit	% selected
Agricultural Products	61%
Three Tubes	60%
Geo Wall	46%
Water Bottles	45%
Underwater Windmills	40%
Science On a Sphere	40%
Rain Table	36%
Oceans Tsunami Theater	33%
Aquifer Interactive	32%
Dam Interactive	28%
Water Conservation Theater	26%
Home Conservation Computer	26%
Ice-Water-Vapor	25%
Playground Pump	25%
Three Gorges	24%
Animals	23%
Wetlands	19%
Lifting Water Jug	8%

A.7 Individual components: recognizing data (continued)

Selected cross-tabulations

recognized data gathered by scientists			age 18-34 (n=142)	age 35-54 (n=203)	age 55+ (n=53)
Animals	yes	**	33%	21%	5%
	no		67%	79%	95%
Dam Interactive	yes	**	17%	33%	39%
	no		83%	67%	61%
Geo Wall	yes	**	63%	36%	46%
	no		37%	64%	54%

recognized data gathered by scientists			group with children 0-12 (n=224)	group with no children (n=175)
Wetlands	yes	**	10%	29%
	no		90%	71%

A.8 Suggestions for improvements

OVERVIEW: About half of the visitors were able to identify something about the exhibition that could be improved. The suggestions varied with only a few visitors choosing any one improvement.

Thinking about the entire exhibit, what is something that could be improved or explained better?

(n=399)	
5%	Rain Table[2]
4%	better explanations for children
4%	more hands-on exhibits
3%	explain aquifer exhibit
3%	What can people do?
2%	What can be done with water bottles?
2%	Geo Wall
2%	How do municipal water systems work?
2%	explain underwater turbines
2%	Science On a Sphere
2%	Three Tubes
2%	water cycle
1%	more about Minnesota
1%	explain playground pump
1%	explain more about pollution
1%	more visual effects
1%	easier to read text
1%	include politics of water
12%	other
52%	nothing/ no answer

[2] Many of these exit interviews were conducted when Rain Table had no interpretive graphics.

B. Study 2: Perceptions of "Science On a Sphere"

Overview: Visitors who were invited to watch and react to the Science On a Sphere program (Blue Planet) watched most of the program and gave mostly moderate-to-high ratings. SOS was effective in conveying information and presenting memorable visual images, but it was less effective in changing how people think about water.

Almost all visitors were able to identify new top-of-mind information from this exhibit: that 3% of all water is fresh water and 1% is usable, the movement of ocean currents and the relative scarcity of fresh water. Upon exiting the exhibit, visitors who were not invited specifically to stop and watch the presentation made similar, but more general observations: the small proportion of fresh water, the tremendous amount of water on Earth, and the interconnectedness of water.

Several of the images that represented specific information were easily recalled by visitors, although some made a greater impact than others. The blue line showing the small percent of Earth's surface water that is fresh water was the most striking content and image for many visitors. Other specific images were also mentioned by some of the visitors: night skies, population growth, water shortage and ocean currents.

Some visitors said that viewing the presentation on the globe changed their thinking about water, but most of these changes were generally just seeing a different perspective on the globe. About half of the visitors were able to articulate something that they were curious about, due to having seen this presentation.

When visitors were personally invited to watch SOS and give reactions:

minutes spent at this exhibit mean: 5:15 minimum: 1:40 maximum: 9:31

Overall rating of this exhibit high: 44% medium: 44% low: 12%

Two things learned about water from this presentation: [partial list]

48% 3% of water is fresh/ 1% is usable
24% ocean currents
22% scarcity of fresh water

Visitors' estimated percent of visual images that were already familiar…

mean: 65% minimum: 10% maximum: 100%

Science On a Sphere (continued)

Here are some topics that may or may not have been shown at some time on the globe. For each one, tell me "yes" or "no" if you saw this here.

Recalled from presentation[3]

95%	the blue line showing fresh water
94%	ocean currents
92%	size of the water area on the surface of the Earth
88%	what the Earth looks like at night
86%	clouds and weather patterns
73%	geographic areas that have inadequate water supply
66%	population growth

Can you tell me two things about water that you got out of this presentation?

48%	3% of water is fresh/ 1% is usable
24%	ocean currents
22%	scarcity of fresh water
12%	agricultural use of water
10%	a lot of water locked in minerals, Earth's crust
8%	71% of Earth's surface is water
6%	water facilitates tectonic plate movement
6%	there will be inadequate water supplies in 2025
4%	seeing the night skies
4%	vapor/ clouds
16%	other (*water in glaciers, Center of Africa has big populations, India produces a lot of crops, how valuable water is, water usage has the biggest effect on environment over the resource use*)
4%	presentation had false information
4%	got nothing from presentation

[3] Not all visitors watched the entire presentation. These percentages only reflect visitors present during that portion of the presentation.

Science On a Sphere (continued)

What ideas or messages can people get from [SOS]? **from exit interviews**

(n=306)

31%	limited amount of fresh water/ need to conserve water
25%	how much water there is on Earth
9%	interconnectedness of world
8%	where people do or don't have access to water
5%	Earth's water is precious
4%	population/ overpopulation
3%	weather
3%	comparison to other planets
2%	amount of water usage
2%	ocean currents
1%	tectonic plates
1%	global warming
8%	just watched/ cool images
10%	don't know / no answer

Is there any particular visual image from this that will stick with you?

24%	boxes, lines representing amount of water
24%	whole thing/ perspective from space/ seeing land masses
18%	night skies
14%	population/ population growth
10%	where there is not enough water
10%	ocean currents
6%	clouds/ water vapor
4%	snow/ seasons
4%	tectonic plates
4%	other
6%	none of the images

Visually, does seeing things on a globe change the way that you think about water?

84%	yes
44%	better perspective on the globe
16%	how little water is available
14%	the large amount of water on Earth
10%	can see movement
6%	global, rather than national perspective
16%	no

Science On a Sphere (continued)

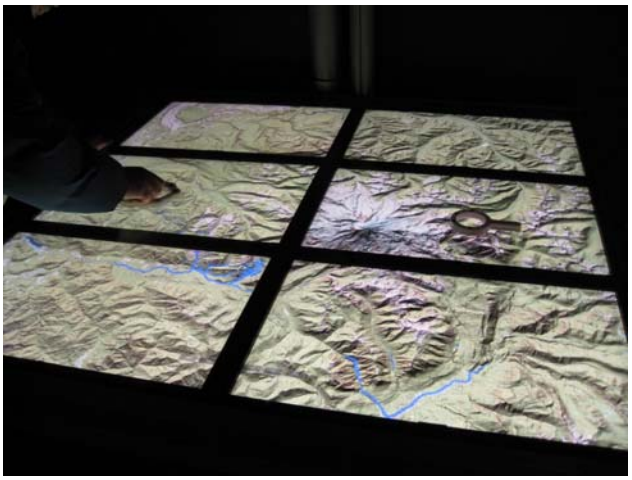
Is there something that you're curious about now that you've seen this?

10%	places w/ limited water supplies
10%	desalinization/ technology
10%	water conservation
6%	water in Earth's crust
4%	what will it be like in the future?
4%	agriculture
4%	climate change
12%	other (*at what points do water currents switch over, what is the other 30% used for other than agriculture, why is my tax money being used to stab me in the back, more about the seasons*)
44%	no

What else about water would be interesting for you to see on this globe?

20%	climate change/ melting ice caps
10%	types of water usage
10%	impact of water shortages on people
8%	precipitation patterns
8%	pollution
4%	alternative sources of water/ desalinization
4%	ocean floor
18%	other (*where water goes when done using it, air currents, maybe a few facts and bullet points, that present some exact number to read, breakdown of fresh water pockets on the round instead of on a line, what you can do to reduce water use, effect of damming, effects of a tsunami, how currents are affected by moon*)
26%	no

C. Study 3: Perceptions of the "Rain Table"



Overview: Visitors were invited to use the Rain Table and give their reactions. Most visitors spent between one and three minutes watching the video and gave it mostly medium or low ratings.

Based on interviews after using the exhibit and interviews after exiting the Water exhibition, most visitors understand that this exhibit is about how water flows in general or specifically how it flows over landscape and contours. Some visitors (about one-fourth) get mistaken impressions from this exhibit: it's about erosion, where rain falls, snow melting and others.

After half of the interviews, a panel was added with the title "Make it Rain" and a U.S. map highlighting the area represented on the Rain Table. This eliminated the misconception among some visitors that this was about snow melt and almost eliminated the questions about "Where is this?" and "What is this about?"

When prompted, just about all visitors recognize the message that rain flows to the lowest point of the landscape and only a few (17%) believe that the exhibit suggests rivers generally flow south.

Almost half of the visitors saw something visual at this exhibit that was different than the way they have thought of water before (mostly seeing how water flows or seeing a topographic view). About half of the visitors were able to articulate something that this exhibit made them curious about, but for many people their curiosity was about trying to understand this exhibit.

Somewhat more than half of the visitors interviewed were able to identify some way in which this exhibit was relevant to Minnesota: the same principles apply in Minnesota, water forms rivers and floods. Other visitors thought that Minnesota's landscape was too different for comparison or just didn't see any connection.

When visitors were personally invited to look at this exhibit and give reactions:

minutes spent at this exhibit mean: 2:34 minimum: 0:31 maximum: 8:02

Overall rating of this exhibit high: 13% medium: 48% low: 39%

At the Rain Table exhibit, invited visitors:
used the cloud and magnifying glass pieces: 93%
just watched others use them: 7%

Some visitors believe that:
Rivers tend to flow toward the south: 17%

Rain Table (continued)

What is the main idea of this exhibit in your opinion?

mostly correct answers

42% how water flows in general
28% movement of water over landscape or contours
7% formation of rivers
3% it's a map/ topography

misunderstandings

8% where rain falls/ weather patterns
7% erosion
5% snow melt
2% underground water
3% other misunderstandings

3% no answer

Here are some ideas that may or may not have been shown in this video. For each one, tell me "yes" or "no" if you saw or thought this here.

Correct responses

96% Rainwater flows downhill to the lowest point of the landscape. (true)
83% Rivers tend to flow toward the south. (false)

35% We need to conserve water as much as possible. (true, but not an exhibit message)
35% Rainwater changes the landscape through erosion. (true, but not an exhibit message)

What ideas or messages can people get from [Rain Table]? **from exit interviews**

(n=128)

41% flow of rain water
17% how landforms determine water flow
13% formation of rivers and lakes
11% erosion
9% weather patterns

3% other
13% other misconceptions
16% don't know / no answer

Rain Table (continued)

Visually, is there something different about this than the way that you've thought of rain before?

42% said "yes"

14%	can see the path of water flow
12%	seeing a topographic view
6%	can see the movement/ it's interactive
5%	just generally a good visual aid
3%	seeing how far water travels
4%	other answers
1%	no answer

58% said "no"

Is there anything you're curious about having seen this?

47% said "yes"

12%	What is this exhibit about?
8%	Where does this map represent?
8%	How does this table's technology work?
5%	I'd like to see a local example or another place
3%	How much precipitation would it take to flood?
3%	How could this water be contained and used?
2%	I'd like to see different forms of precipitation?
2%	What the actual rainfall amounts?
2%	Where does the water collect?
2%	How fast does the water flow?
5%	other answers (where does watershed end?, why people build in flood zones?, how rainfall affects everything, etc.)

53% said "no"

Rain Table (continued)

How might this light table be relevant to Minnesota?

22%	same principles as in the exhibit
12%	not relevant, Minnesota has different landscape
11%	it shows how rivers drain/ could show how the Red River flows
7%	related to floods in Minnesota
5%	shows erosion/ how river bluffs were formed
5%	how water flows to our lakes
10%	other answers
7%	don't know because I don't live in Minnesota
24%	don't know

Sample answers

same principles as in the exhibit

Same principles.
Same basic ideas here - higher to lower elevations, even though we don't have mountains.
Flows from higher points to lower and connects many rivers.
If you put a map of MN, you'd see the same thing - how MN's landscape was conceived.
Relevant to everywhere, works the same everywhere
Rain falls and lands, runs down
Difference of elevation - completely relevant, even though 8,000 feet on this versus much less here.
Does what you are showing on table.
It seems to be rainfall anywhere. Bodies of water get bigger and bigger as flow continues.

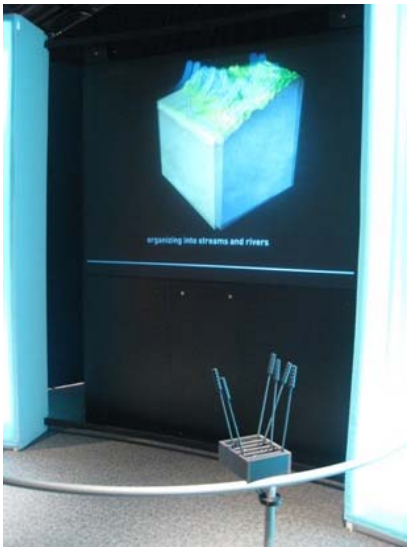
not relevant, Minnesota has different landscape

Not at all, I don't think that that is MN.
Not sure. It looks awfully mountainous and I don't think of MN as having mountains.
Got a lot of rivers and lakes, not a lot of mountains.
Has more hills and mountains than MN- landscapes are different
Not as many mountains in Minnesota
Very flat here. Looking at elevation changes, so not so much.

it shows how rivers drain/ could show how the Red River flows

Rivers here flow south. Most of them, except the Red River.
Relevant to Red River- maybe use a local map
Help us to learn about our own river system, Mississippi
Watching water flow into Mississippi River

D. Study 4: Perceptions of the "Geo Wall"



Overview: Visitors were invited to watch the Geo Wall video and give their reactions. Most visitors spent between two and five minutes watching the video and gave it mostly medium or low ratings.

The exhibit is somewhat effective in conveying factual information among visitors who were invited to watch the presentation. Most of these visitors recognized that aquifers can be overused, reducing the water available for the future and about half got the message that overuse of ground water in the Tucson Basin is an ongoing problem. Most visitors realized that drought was not the underlying cause of shortage of water in Tucson. When asked what the video was about, almost all visitors identified some aspect of the content from the video: ground water, loss of ground water, Tucson, water use and changing water table. Few were unable to give an accurate example of content. Visitors interviewed while exiting the Water exhibition, on the other hand, demonstrated much less understanding of the content even though they claimed to have stopped long enough to understand what the exhibit was about. It appears that visitors who are not specifically invited to observe this exhibit gain little understanding of the content.

About 40% of the visitors interviewed at the exhibit thought that the 3-D presentation was better than regular video, while others thought the 3-D presentation was "about as good" (36%) or "not as good" (24%) as regular video. Those who liked the 3-D presentation thought it was more attractive or provided a better perspective. Those who disliked the 3-D presentation thought the glasses were difficult to use, didn't add to the presentation or found the images were still fuzzy (it's unknown whether they were using them correctly).

Most visitors interviewed at the exhibit (63%) found that the images helped them realize something new: particularly the Statue of Liberty comparison showed depth of ground water and other images showed the loss of ground water. About half of the visitors were able to identify something they were more curious about having seen this video: how Tucson will get water in the future, how water can be conserved, where else it might happen and a variety of other topics.

When visitors were personally invited to look at this exhibit and give reactions:

minutes spent at this exhibit mean: 3:09 minimum: 0:36 maximum: 6:11

Overall rating of this exhibit high: 13% medium: 44% low: 43%

Having the 3-D graphic presentation was:

better than regular video:	39%
about as good as regular video:	36%
not as good as regular video:	24%

Geo Wall (continued)

Most of the visitors invited to watch the presentation were able to recognize some way in which the information in this video is relevant to people in Minnesota: Minnesotans rely on aquifers and a shortage could happen here. About one-third thought that Minnesota is too different for this information to be relevant or just could see no connection.

A title (Why is Tucson Sinking?) was added halfway through the data collection. The data suggest that this had no significant impact on visitors' responses.

Would you say that having the 3-D graphic presentation was… better than having regular video, about as good, or not as good as regular video?

39% said "better"

22%	attracts attention/ it's more fun
10%	improves the perspective/ has better images
8%	more interesting for children
4%	it gets information across better

36% said "about as good"

24% said "worse"

9%	glasses are hard to use, uncomfortable
9%	it doesn't add anything to the presentation
7%	images were fuzzy even with the glasses
4%	the text is hard to read with the glasses

Geo Wall (continued)

What is this video about?

51%	water/ ground water/ aquifers
36%	loss of groundwater
23%	Tucson
16%	water use/ water conservation
12%	change in the levels of groundwater
7%	city built where water is inadequate/ poor planning
6%	aquifer process
3%	unclear or mistaken answer
2%	no answer

Here are some ideas that may or may not have been shown in this video. For each one, tell me "yes" or "no" if you saw or thought this here.

Correct responses

69%	Pumping water our of the ground faster than nature replaces it can reduce the amount of water available for future uses. (true)
55%	The water supply for Tucson is inadequate for its population and the problem can't be fixed completely. (true)
30%	When the level of underground water falls dramatically over a long period of time, the land surface slowly sinks. (true, but only mentioned on a text panel)
23%	A period of drought in Tucson is the main reason there's a problem with the water supply. (false)

What ideas or messages can people get from that? **from exit interviews**

(n=130)

15%	need to conserve water
13%	decline of water tables
8%	amount of underground water
6%	shouldn't build in the desert
4%	various misconceptions
4%	other
7%	just looked at 3-D
39%	don't know / no answer

Geo Wall (continued)

Did the images in this video help you realize something that you didn't realize before?

63% said "yes"

27%	comparison with Statue of Liberty was effective, showed depth of ground water
22%	the loss of groundwater, water consumption
7%	changing water table
5%	how aquifers are recharged
4%	geologic processes (Tucson basin, sediment forming valley of rock)
3%	generally better perspective

37% said "no"

Is there anything you're curious about, having seen this?

48% said "yes"

11%	How will Tucson get water in the future
10%	What can be done to conserve water?
8%	Where else does this happen? / How does it compare with other places?
6%	Why use Colorado River water?
5%	What are the causes?
4%	What is the situation where I live?
2%	How is the water wasted?
6%	other answers
1%	no answer

52% said "no"

Geo Wall (continued)

How might the information in this video be relevant to Minnesota?

36%	It could happen here/ we should conserve water
30%	People here use water from aquifers/ we have aquifers
20%	It's not a problem in Minnesota
9%	It's the same problem in any metro area
5%	Dry parts of the country might want to take water from Minnesota
2%	There is more agriculture here
2%	don't know because I don't live in Minnesota
14%	don't know

Sample answers

It could happen here/ we should conserve water

We have water table, and supply and demand affects it.
There's ground water here too.
You have to watch out for your water anywhere, for future generations. Springs aren't going to last forever.
We have a water table too and we probably are using it faster than it can replenish itself.
Suppose it could happen in Minnesota.
We all need to conserve water.
We all have issues with how much water we use. Our water tables are different but important.
Our water tables are also going down.
As our population expands we'll face freshwater shortages even in the land of 10,000 lakes.
Looking at underground water here in Minnesota and what we can do to conserve it.
Particularly southwest MN, used for ethanol production, parts of MN getting drier, policies to MN but we are not public education not addressing tradeoffs.

People here use water from aquifers, we have groundwater

Some people get water from aquifers. Water is a big issue here, too.
We have a big aquifer under us. Let's learn a lesson from other places.
We all use water, and we have an aquifer.
It's relevant - we have a lot of wells and people working with water underground.
It's relevant anywhere because we use it.
Water is a resource we all use.
Everybody uses groundwater

Geo Wall (continued)

Sample answers (continued)

It's not a problem in Minnesota

People from Tucson should move to Minnesota because we have more water.
Maybe not so relevant here. We have a different area.
Aquifers not as depleted in Minnesota. We don't need to conserve water.
We have a lot of water here.
It's not that bad (loss of water) in Minnesota.
It's hard to compare because you're going from a dry area to the land of 10,000 lakes. They're opposites.
We have the Mississippi and I don't think groundwater is a problem, but more irrigation - how other areas are using Mississippi and what are we doing that might affect other people farther down the river

It's the same problem in any metro area

In Twin Cities area, can give us an idea of what over pumping can do.
Same situation in major metropolitan areas.
More people that move to and live in MN, more they'll affect the water.

Dry parts of the country might want to take water from Minnesota

They'll want our water piped to Tucson.
They could get their water from MN
Being on great lakes, all freshwater we have, 20% of usable world water will they need ours when they run out?

E. Study 5: Perceptions of "Three Tubes"

Overview: Visitors were invited to observe the 3 Tubes exhibit and give their reactions. Most visitors spent between two and three minutes observing the exhibit, watched three or four screens and gave it mostly medium or low ratings.

The exhibit is very effective in conveying factual information. Almost all visitors (whether they were invited to use the exhibit or were interviewed at the end of the exhibition) were able to identify something they learned from this exhibit: how much water we use, comparisons between countries, and the importance of conservation. Asked about four possible messages from the exhibit (three true and one false), the large majority of visitors recalled each one correctly. After seeing this exhibit, about half of the visitors said they were curious to learn about something else: conservation measures, comparisons to other countries or the role of agriculture in using water.

Some visitors recognized that the exhibit presented actual data (about one-third) and a few recognized that the tubes constituted a bar chart.

minutes spent at this exhibit mean: 2:27 minimum: 0:24 maximum: 5:34

Overall rating of this exhibit high: 14% medium: 44% low: 42%

Understanding of the main ideas:
- 46% identified major theme
- 60% identified minor theme
- 8% identified vague/ambiguous idea
- 10% wrong/ no idea

# of questions read on 3 Tubes screen:
- 1 question: 2%
- 2 questions: 14%
- 3 questions: 36%
- 4+ questions: 38%
- unsure: 10%

3 Tubes (continued)

Correct responses

90% Some countries have much greater demands for fresh water than they have supplies of it. (true)
90% Water use is much greater in the U.S. and Canada compared with the rest of the world. (true)
90% The U.S. has the world's largest supply of fresh water. (false)
88% Around the world, agriculture uses more fresh water than industry and domestic use. (true)

What's the main idea of this exhibit in your opinion?

40% how much water we use
32% comparisons among countries
20% importance of conservation/ wasting water
10% scarcity of fresh water
8% how water is used
6% amount of water we have available

8% unclear answer

Sample responses

how much water we use

Make people aware of water usage.
Human consumption of fresh water.
The need to conserve water. Americans use a lot of water.
Water efficiency.
To show us how much water we use.
To show that people use a lot of water.
Show water usage.
How much water we use.
How much water people use.
Show how people in U.S. use a lot of water.
Show how much water is being used.
Show how people in U.S. use a lot of water.
Show how much water is being used.

3 Tubes (continued)

Sample responses

comparisons among countries

To display differences between western and other countries around the world.
To show how much water we use here in comparison to other countries.
Demonstrating how different cultures, US is particular, utilize water.
Disparity between different countries' water consumption.
To show, visually see the percentage, how much water we use compared to other countries.
How much water we use compared to other countries.
Show how much water is used in the world on regular basis. Who uses it, for what.
To show how much water we use. To compare water use.
Try to put it in comparative context but it's hard to do without knowing populations. Would like to know how Great Britain is so efficient.

importance of conservation/ wasting water

How to manage water better.
To show us how we are wasting water, to get our minds into conservation.
Conservation.
Talk about the importance of water conservation.
Focusing on importance of not using so much water in the U.S. Conserving water.
To show how water is not used most wisely.
Show that we use too much water.
We use too much water in America.
How to save water.

scarcity of fresh water

To let people have an idea of how scarce fresh water is
Making us aware of a natural resource going away
Not much left.
Raise awareness of the finite water available.
It shows how we are misusing our water resources.

3 Tubes (continued)

What ideas or messages can people get from that? **from exit interviews**

(n=116)

35%	comparisons with other countries
20%	how much water we use
18%	need to conserve water
14%	how water is used/ water use by agriculture
8%	how much water there is
5%	other
11%	don't know / no answer

Is there something that you're curious about now that you've seen this?

22%	how can we use water more efficiently
14%	comparisons to other countries
8%	role of agriculture
4%	how other countries are more efficient
6%	other
50%	no

Does the rising and falling water in the tubes help anything about your experience of this exhibit?

36%	visually interesting/ provides new perspective
34%	gives visual understanding of data
8%	good for the kids
8%	too slow/ hard to see
22%	no

Visually, is there something different about this, than the way you've thought of water before?

16%	it presented graphs, data
14%	it showed comparisons/ put in perspective
12%	mentioned specific content (not about visual displays)
58%	no

F. Characteristics of Visitors to the Water Exhibition

OVERVIEW: The Water exhibit seemed to have attracted an audience similar to the Museum's general visitor audience in gender, education and group composition. The Water exhibition attracts slightly fewer older visitors and slightly more families. About one third of visitors who saw the Water exhibition identified themselves as members of an environmental organization.

	Water exhibit visitors (n=399)	SMM visitor profile
Age:		
<18-24	16%	13%
25-34	20%	22%
35-44	33%	20%
45-54	18%	17%
55-64	9%	14%
65+	5%	13%
Gender:		
women	57%	60%
men	43%	40%
Education:		
some school	3%	1%
high school	6%	6%
some college	24%	24%
college grad	38%	41%
graduate school	29%	29%
Group composition:		
adult group	37%	45%
families with children	63%	55%
Groups with children in age groups:[4]		
0-5	20%	
6-12	46%	
3	18%	
Group size:		
1	6%	2%
2	30%	45%
3	19%	21%
4-5	34%	13%
6+	11%	9%
Member of environmental organization:		
yes	34%	
non	66%	

[4] Some groups have children of various ages and are included in more than one of these categories.