Living With Hurricanes: KATRINA & BEYOND
at the Louisiana State Museum in New Orleans

Summative Evaluation

Conducted by People, Places & Design Research
in collaboration with the staff of the Louisiana State Museum

Summative Evaluation of
Living with Hurricanes: Katrina and Beyond

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research report prepared by
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Executive Summary

The purpose of this Summative Evaluation was to assess visitors' use and perceptions of 'Living with Hurricanes: Katrina & Beyond' at the Louisiana State Museum (LSM) as an informal science experience. The exhibition is distinctive in that it is presented in a museum which has been primarily focused on history. The overall experience, affective impact and learning were evaluated for visitors leaving the exhibition. More specific questions of science learning were evaluated in mini-studies in Room 3. This report also examines the degree to which emotion affects informal learning in the museum environment.

Research Method

Several methods were used to investigate visitors' experience with the 'Living with Hurricanes' exhibition. The principal method for this evaluation consisted of intercept interviews with randomly selected visitors leaving the exhibition. This method is the most common and accepted method for summative evaluations for important reasons: it makes sense to visitors, and therefore almost all visitors cooperate with the process (in this example, over 95% of the visitors approached agreed to participate in an interview); secondly that broad cross-section of the audience helps create a valid evaluation, because with almost everyone participating the sample will include people who were highly impressed or not so impressed, people who learned a lot or didn't learn much; and thirdly, this is a point at which the exhibit experience is fresh in people's minds, and they are able to answer a variety of questions about specifics as well as overall impressions (put another way: if they haven't picked up on the main interpretive messages by the time they leave the exhibition, it's very unlikely that they will get them later; therefore, this moment of measurement does not confuse visitors' ability to grasp the interpretive story and messages with the recall of those messages later). In these exit interviews with randomly selected visitors, people were asked about their overall opinions, the messages learned and their emotional reactions to the exhibition. LSM staff and other interviewers (former or current graduate students in social sciences) conducted 406 interviews with adult visitors exiting the Living with Hurricanes exhibition.

In addition, five 'mini studies' were conducted to supplement that primary method, involving a study of children's reactions to the exhibition and four studies of the Hurricane Science section. The study of 67 children's reactions was conducted in a similar manner to the exit interviews except the interview was much briefer and questions accessible to young children. The four studies that were specifically focused on the Hurricane Science section (room 3 of the exhibition) consisted of two interview studies focused on exhibits and messages (30 visitors interviewed about that section overall, and another 30 interviewed about the Levee Engineering area), a study of affective response and time spent in science learning was based on observations and brief interviews with 78 visitors. Lastly, systematic observations regarding 72 visitors to describe the use of exhibits and time spent in that room.

Annotated plan of the exhibition space

Major Findings

Who's visiting? The large majority of visitors to this exhibition are from outside the Gulf Coast region and therefore few were directly affected by the Katrina disaster. Many visitors are less familiar with hurricanes as one would experience them in the Gulf of Mexico. Compared with museum audiences in general these visitors are similar in some ways, such as that they are highly educated and there are more women than men. However, this audience differs from most history museum audiences, attracting a wide age-range not just older adults.

Patterns of use of the exhibition. The exhibition is designed so that visitors experience a linear series of rooms. Anecdotally, it's clear that visitor groups sometimes divide and some backtrack through parts of the exhibition. Regardless of some changes in direction, it is still a mostly linear experience: almost all visitors enter the designated entrance and continue to the end, exiting to the lobby from the last room. Thus people have the opportunity to see the entire exhibition even if they choose to skip certain exhibits. On average, visitors report spending about 60 minutes in the exhibition, which is a long time compared to most exhibitions.

Reactions to the exhibition. Visitors expressed moderately positive to very positive ratings for the exhibition as a whole. The most engaging rooms are Room 2 (the aftermath of the storm, called "Is This America?") and Room 4 (the last room, focusing on recovery, called "Where Do We Go From Here") -- both of which present factual information but are dominated by human stories related by individuals in multi-media presentations.

STEM learning. Visitors reported learning a great deal during their visit. Three-quarters of the visitors interviewed said they understood something better having seen the exhibition, compared to what they understood before. People living outside the Gulf Coast region were even more likely to say they learned something, whereas Gulf Coast residents claimed to have learned less, while young adults and more-educated visitors reported learning more. About half of all visitors said the exhibition increased their interest in learning about the science of natural disasters.

Learning about levees. Top-of-mind statements and recall of major themes suggest that STEM learning is greatest with regard to engineering levees and how they failed. The depth of learning about levee failures is greater than other STEM learning. Visitors cited poor construction and design (depth, I-walls, soil), lack of maintenance, and the multiple ways they can fail.

Learning about wetlands. Although learning about wetlands was perhaps not as deep as learning about levees, it was broad in that the large majority of visitors indicated learning something about wetland destruction and the importance of wetlands in mitigating the impact of hurricanes and storm surge.

Learning about hurricanes. Relatively few people reported learning something about how hurricanes function (the local bias toward "I already know about that."). Most of what visitors indicated they learned about "hurricane science" was descriptive: the path, categories of intensity, damage caused and impact on people.

Learning about emergency management. For the most part, people were aware of emergency management issues, but were unclear about them. They noticed problems with emergency management in Room 2 (the aftermath) and to a lesser extent in Room 3 (the "What Happened?" /science room, where emergency management issues were more systematically analyzed). Most visitors blamed the government for the severity of the disaster but failed to see how the lessons from this disaster applied to their own lives since they don't live in a hurricane-prone area.

Other learning The timeline of events and the geography of New Orleans seemed to be essential background that most visitors from other states and countries lacked before their visit to the museum, but they became aware of that content here.

Affective reactions. The exhibition provides a "moving experience" for most visitors who thought that it evoked moderate to strong emotions – primarily "sadness" and "empathy," but half also chose "respect for people who acted," "hope" and "frustration" as good descriptors.

The emotions that most contributed to stronger emotional reactions were "anger," "respect for people who acted," "sadness" and "scary." "Hope," "surprise," "frustration" and "empathy" had less influence on how visitors reported the intensity of emotional experience.

Relationship between affective engagement and the exhibition experience. Emotional impact from the exhibition had substantial impact on other aspects of visitors' experiences. People who had a stronger emotional experience rated the exhibition more highly (65% of those gave it the highest ratings), were more likely to say they learned something new about hurricanes and disaster management, and saw greater relevance to their own lives. They were not, however, different in recognizing major themes and did not spend more time or less time exploring Room 3 ("What Happened?" /the science room) than people who experienced less emotional impact.

Relationship between experience in Hurricane Katrina and the exhibition experience. People who had direct experience of the Katrina disaster seemed to be less engaged by the exhibition, but even more pleased. The data showed that people who were directly affected by the Katrina disaster tended to spend less time in the exhibition, had less emotional impact and learned less, but (along with people indirectly affected during Katrina) they rated the overall experience higher than other visitors. These visitors appear to have brought some emotional and intellectual guardedness with them, but were still pleased with the exhibition.

Engaging science exhibits. The most engaging science exhibits in Room 3 ("What Happened?") are primarily interactives and media at the entrance and on the shortest path through the room. The levee break video is the first exhibit that most visitors notice upon entering the room; along with being visually interesting and presenting audio with compelling stories, it answers a question that many visitors have: where did the water come from? The Emergency Management area is farthest from the entrance and engages the fewest visitors. It appears that some visitors are either overwhelmed by the content at this point, or simply not interested in science and interactive exhibits and therefore pass through as quickly as possible.

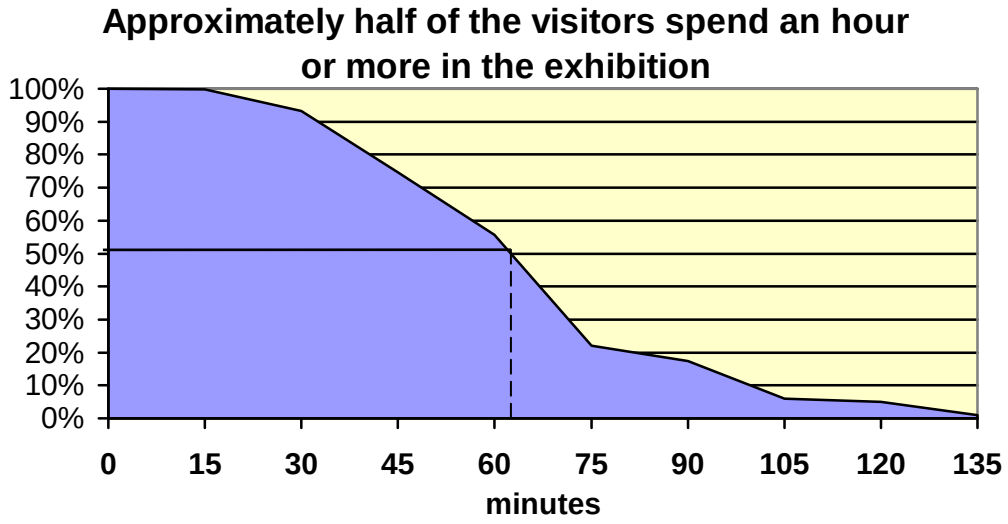
A. Overall Exhibition Experience

This section reviews people's use of the exhibition as well as intellectual and emotional reactions.

- **The overall ratings of the exhibition by visitors were high.** People who were directly affected by Katrina, visitors emotionally affected by the exhibition, women and those who saw relevance to their lives were the ones most likely to give the exhibition high ratings. Although visitors' overall evaluation of the exhibition was high, their evaluation of specific rooms ranged from low to moderately high. Room 2 (Aftermath) and Room 4 (Recovery) were most highly rated.
- **Visitors spent an hour on average in the exhibition, but some spent more time in the exhibition than others.** People who were directly affected by Katrina spent less time and visitors who were emotionally affected by the exhibition spent more time.
- **For most visitors the exhibition evoked a high level of emotional reaction.** Over half of the visitors described the emotional impact as "a great deal" or "extremely strong." The specific emotions they mentioned were most often "sadness" and "empathy." The emotions that were most related to a higher level of impact were "anger," "respect for people who acted," "sadness" and "scary."
- **Most visitors (76%) indicated that they learned something new in the exhibition: levee engineering and failure, the timeline of events and the impact on people in the aftermath of Katrina.** People who were directly affected and others living in Gulf Coast states were least likely to say they learned something new. The people most likely to have learned something new were young adults and highly educated visitors.

A.1 Time in the exhibition

OVERVIEW: Visitors spent a considerable duration of time in the Living with Hurricanes exhibition[1] – a mean of 58 minutes, a median of 60 minutes (and over 90% spent at least 30 minutes). Louisiana residents spent less time, on average, than visitors from out-of-state. People tended to stay longer if they said the exhibition had a stronger emotional impact on them.



		if stronger [2] emotional impact (n=255)	if lesser emotional impact (n=149)
Minutes spent in the exhibition	**	61	52

		Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
Minutes spent in the exhibition	**	49	62	58	60

** = 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.

[1] Time estimates given by visitors (checking their watches, discussing, etc.) during exit interviews.
[2] "Stronger" emotional impact includes people who said its impact was "a great deal" and "extremely strong," and "lesser" emotional impact includes "a moderate amount," "a little" and "none" (see section A.3).

A.1 Time in the exhibition (continued)

		adult-only groups (n=345)	family groups (n=55)
Minutes spent in the exhibition	**	59	52

		directly affected by Katrina[3] (n=34)	indirectly affected by Katrina (n=36)	emotional connection. w/ Katrina (n=101)	not affected by Katrina (n=233)
Minutes spent in the exhibition	**	48	59	58	59

[3] "Directly affected" includes people who lived in the area hit by Katrina. "Indirectly affected" includes people with immediate family in the area hit by Katrina and people who personally housed evacuees. "Emotional connection" includes people who said they were "personally impacted" but were living elsewhere and only cited an emotional reaction to the disaster.

A.2 Overall reactions

OVERVIEW: Overall reactions to the exhibition were very positive — about half gave the exhibition a high rating and most of the rest gave it a medium rating. The ratings of any of the specific rooms did not reach the same level as the overall exhibition, but Room 2 and Room 4 were most appealing to visitors. The Lobby and Room 3 were less appealing than the other rooms.

An ancillary set of interviews with 67 children provide some additional context for how their reactions might differ from those of adults. Part of the table below shows that children gave somewhat lower ratings to the overall exhibition than did adults.

	adults (n=405)	children (n=67)
rating the overall experience		
high (9-10)	**54%**	36% high
medium (7-8)	42%	
low (1-6)	4%	64% med/low
rating the Lobby		
high (9-10)	27%	
medium (7-8)	38%	
low (1-6)	33%	
rating Room 1: history, & the storm		
high (9-10)	39%	
medium (7-8)	42%	
low (1-6)	19%	
rating Room 2: the aftermath		
high (9-10)	**48%**	
medium (7-8)	38%	
low (1-6)	14%	
rating Room 3: hurricane science		children
high (9-10)	29%	34% high
medium (7-8)	42%	
low (1-6)	30%	66% med/low
rating Room 4: recovery		
high (9-10)	**47%**	
medium (7-8)	39%	
low (1-6)	14%	

A.2 Overall reactions (continued)

OVERVIEW: The data showed some variation in overall ratings of the exhibition according to some visitor characteristics. People who were directly affected (evacuated, had personal or financial loss) or indirectly affected (helped with recovery, housed evacuees) by Katrina were somewhat more likely to give the exhibition high ratings than visitors who were not personally affected by Katrina. Women, people who experienced a stronger emotional impact and people who saw relevance in the exhibition were all more likely to give the exhibition high overall ratings.

Selected cross-tabulations		directly affected (n=34)	indirectly affected (n=140)	not affected (n=230)
rating the experience				
high	**	**59%**	**59%**	50%
medium		29%	38%	47%
low		12%	3%	3%

		men (n=153)	women (n=233)
rating the experience			
high	**	44%	**63%**
medium		50%	34%
low		6%	3%

		stronger emotional impact (n=255)	lesser emotional impact (n=149)
rating the experience			
high	**	**65%**	36%
medium		33%	57%
low		2%	7%

		saw relevance (n=156)	did not see relevance (n=211)
rating the experience			
high	**	**63%**	47%
medium		34%	50%
low		3%	3%

A.3 Emotional reactions

OVERVIEW: Most visitors indicated that the exhibition had some emotional impact on them — over half said the impact was "a great deal" or "extremely strong." .

The regression analysis suggests that the specific emotions that most contribute to the emotional impact are "anger," "respect for people who acted," "scary" and "sadness." Much less important were "empathy," "surprise," "hope" and "frustration."

Did this exhibit have any emotional impact on you or not really?

	(n=405)
extremely strong	18%
a great deal	45%
a moderate amount	29%
a little	5%
none	4%

Regression analysis of specific emotions on level of emotional impact

Dependent variable: level of emotional impact

Statistically significant independent variables	coefficient	std. error	significance[4]
constant	4.672	.362	.000
anger	.311	.099	.002
respect for people who acted	.306	.093	.001
scary	.288	.105	.007
sadness	.206	.100	.040
Not statistically significant independent variables			
chaotic	.197	.112	.080
why didn't people leave?	.153	.119	.199
empathy	.093	.096	.335
surprise	.095	.118	.424
hope	.069	.092	.453
frustration	.040	.096	.676

For children, 80% mentioned a specific negative [**??**] emotion such as "sadness," "hope" and "respect for people who acted."

[4] Significance below .05 indicates a statistically meaningful impact based on generally accepted standards.

A.3 Emotional reactions (continued)

OVERVIEW: The strength of emotional reaction was correlated with two characteristics: women, and members of environmental organizations. People directly impacted by the disaster may have slightly greater emotional reactions, but the number of people included in the study is too few for a confident conclusion about a relatively small difference in emotional impact.

Selected cross-tabulations		directly affected (n=34)	indirectly affected (n=140)	not affected (n=230)
extremely strong/ a great deal		71%	67%	60%
none/little/moderate amount		29%	33%	40%

		environmental organization member (n=162)	not a member (n=241)
extremely strong/ a great deal	**	**71%**	58%
none/little/moderate amount		69%	42%

		men (n=153)	women (n=233)
extremely strong/ a great deal	**	49%	**72%**
none/little/moderate amount		51%	28%

	Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
extremely strong/ a great deal	76%	65%	62%	59%
none/little/moderate amount	24%	35%	38%	41%

		age 18-44 (n=112)	age 45-64 (n=156)	age 65+ (n=137)
extremely strong/ a great deal	++	55%	63%	69%
none/little/moderate amount		45%	27%	31%

Reminder: Statistical significance for comparisons in this report is indicated by:
** = statistically significant (usually $\mathbf{X}^2$) at p<.05, or
++ = not quite statistically significant (.10>p >.05), but may have some intuitive value.

A.3 Emotional reactions (continued)

OVERVIEW: The emotions that visitors were most likely to associate with the exhibition are sadness and empathy while far fewer chose "scary," "chaotic," "why didn't people leave" or "surprised." Children were most likely to choose "sadness" but also "respect for people who acted" and "hope."

Residents of different geographic areas had somewhat different emotional reactions to the exhibition. Visitors from other countries were somewhat less likely to choose "sadness, "frustration" and "empathy." Gulf Coast residents (not from Louisiana) were somewhat more likely to choose "chaotic" and "why didn't people leave?" People who were directly or indirectly affected were more likely to choose "scary."

Which of these feelings would you say this exhibition is likely to communicate to most people? (You can choose as many as you want.)

	adults (n=405)	children (n=67)
sadness	**68%**	**70%**
empathy	**67%**	32%
respect for people who acted	**57%**	48%
frustration	**53%**	26%
hope	**50%**	48%
anger	41%	20%
scary	32%	39%
chaotic	26%	21%
why didn't people leave?	20%	29%
surprised	20%	41%

Selected cross-tabulations

Selected emotions		Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
sadness	**	**76%**	**69%**	**71%**	52%
empathy	++	74%	77%	70%	55%
frustration	**	47%	**54%**	**57%**	40%
chaotic	**	8%	**42%**	28%	25%
why didn't people leave?	**	18%	**50%**	19%	15%

		directly affected (n=34)	indirectly affected (n=140)	not affected (n=230)
scary	**	**41%**	**41%**	25%

A.4 Interest in science

OVERVIEW: Approximately half of the visitors interviewed indicated that their interest in the science behind natural disasters had increased during their visit. For some the increased interest was about specific facets of science: levee engineering, environmental preservation, hurricanes, etc. For others, the increased interest is in general awareness and preparedness.

After your visit today, would you say your interest in the science behind natural disasters is more, less or the same as before your visit?

	(n=405)
more	51%
same	49%
less	<1%

[for visitors who said "more"] ***In what sense?***

14%	levees, engineering
12%	to be prepared for the future, to protect
9%	environmental preservation, importance of wetlands
7%	hurricane formation, prediction
5%	more aware, learned something (general)
3%	emergency management
3%	social political factors
3%	I understand how everything happened or why
2%	climate science, global warming
3%	other

A.4 Interest in science (continued)

OVERVIEW: A greater interest in science was more likely among people with a stronger emotional impact and younger adults. The data also suggest that Gulf Coast residents are somewhat less likely to have an increase in interest in science; men are slightly more likely to say their interest in science increased.

After your visit today, would you say your interest in the science behind natural disasters is more, less or the same as before your visit?

Selected cross-tabulations

		stronger emotional impact (n=255)	lesser emotional impact (n=149)
more interest in science	**	**55%**	44%
same/less interest in science		45%	56%

		age 18-44 (n=112)	age 45-64 (n=156)	age 65+ (n=137)
more interest in science	**	**61%**	46%	48%
same/less interest in science		39%	54%	52%

		Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
more interest in science	++	47%	27%	53%	53%
same/less interest in science		53%	73%	47%	47%

		men (n=153)	women (n=233)
more interest in science	++	56%	46%
same/less interest in science		44%	54%

A.5 Top-of-mind learning

OVERVIEW: Most visitors indicated that they understood something better after having seen the exhibition. Most frequently they cited learning about levees, the timeline of the disaster, the aftermath and a variety of other topics. More details about learning, beyond top-of-mind perspectives, are presented in Sections B and C of this report.

Is there anything you understand better having seen this exhibit, compared to what you understood before?

(n=405)

yes	76%
no	24%

What do you understand better now?

26%	levee failures, engineering decisions
17%	timeline, details of what happened
14%	aftermath, stories of how people were affected
8%	wetlands
7%	lack of preparation, evacuation plan
7%	magnitude of storm
5%	lack of response by government, FEMA
4%	responders, rescues
3%	recovery
2%	how hurricanes form
2%	science
1%	feelings, sounds, visuals

A.5 Top-of-mind learning (continued)

OVERVIEW: There was considerable variation in who reported learning something in this exhibition. People who were directly affected were very unlikely to say they learned anything new. People who live in Louisiana or other Gulf Coast states were somewhat less likely to indicate they learned anything new.

Younger adults and visitors in adult-only groups and those with higher education were most likely to say they understood something better. Stronger emotional impact had no correlation with top-of-mind learning.

Selected cross-tabulations		directly affected (n=34)	indirectly affected (n=140)	not affected (n=230)	
understand something better	**	32%	**74%**	**84%**	
do not understand better		68%	26%	16%	
		Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
understand something better	**	50%	52%	**82%**	**78%**
do not understand better		47%	48%	18%	22%
		age 18-44 (n=112)	age 45-64 (n=156)	age 65+ (n=137)	
understand something better	**	**88%**	72%	72%	
do not understand better		12%	28%	28%	
		adult-only groups (n=345)	families with children (n=55)		
understand something better	**	**78%**	66%		
do not understand better		22%	34%		
		less than college (n=78)	college degree (n=148)	graduate school (n=179)	
understand something better	**	53%	**76%**	**86%**	
do not understand better		47%	24%	14%	
		stronger emotional impact (n=255)	lesser emotional impact (n=149)		
understand something better		76%	76%		
do not understand better		24%	24%		

B. Understanding the Science

This section reviews people's understanding of hurricane science, levee engineering and disaster management.

- **Most visitors indicated that they learned something about engineering and environmental decisions, primarily levees and wetlands destruction.** Visitors demonstrated a solid understanding of the factors that had the most impact on levee failures.
- **Slightly less than half thought the exhibition was relevant to disasters where they live.** Visitors from other Gulf Coast states, middle-aged adults (45-64 years old) and those who had a stronger emotional reaction were most likely to see the relevance of the exhibition for disasters where they live.
- **Most visitors did not claim to understand hurricane science a lot better than before seeing the exhibition.** Familiarity with hurricanes in general probably limited the answers about learning. They most frequently mentioned how they develop, the damage they do and the role of water temperature in making hurricanes stronger. The people who learned the most about hurricane science were those from other countries, members of any environmental organization, those most emotionally affected by the exhibition and those least directly affected by the disaster.

B.1 **Understanding hurricanes**

OVERVIEW: Visitors were asked if they understood how hurricanes function better than before their visit and about two-thirds said "a little better" or "much better." They most often mentioned how hurricanes develop, the impact on people and the influence of water temperature.

Would you say that you understand how hurricanes function much better, a little better or not better than before visiting today?

	(n=405)
much better	17%
a little better	47%
not better	36%

In what sense do you understand better how hurricanes function? **(only asked if they answered "much better" or "a little better.")**

15%	how they develop and strengthen, the categories
8%	focus on the damage, flooding, aftermath
7%	role of water temperature
4%	difficulty of predicting, speed and direction changes
4%	the power, destructiveness
4%	role of wetlands, levees
3%	safety, how to protect
2%	effects of high winds, power of wind
2%	effects of storm surge
2%	the science, Room 3
2%	mentions a specific display
2%	knew nothing before
1%	seeing, experiencing
3%	other /vague
1%	already aware
8%	blank, don't know

B.1 Understanding hurricanes (continued)

OVERVIEW: Patterns of demographic differences in understanding hurricanes are similar to those for top-of-mind learning (Section A.5). People from the Gulf Coast and those directly affected by the disaster indicated that they were less likely to learn something about hurricanes while members of environmental groups were somewhat more likely to mention learning something. In one notable difference from top-of-mind learning, people with a stronger emotional impact were somewhat more likely to indicate learning something about hurricanes.

Selected cross-tabulations

		stronger emotional impact (n=255)	lesser emotional impact (n=149)
understand hurricanes better	**	**68%**	55%
do not understand better		32%	45%

		directly affected (n=34)	indirectly affected (n=140)	not affected (n=230)
understand hurricanes better	**	44%	**62%**	**67%**
do not understand better		56%	38%	33%

		Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
understand hurricanes better	**	53%	35%	**64%**	**79%**
do not understand better		47%	65%	36%	21%

		environmental organization member (n=162)	not a member (n=241)
understand hurricanes better	**	**70%**	59%
do not understand better		30%	41%

B.2 Understanding engineering and environmental decisions

OVERVIEW: Most people (about three-quarters) indicated learning something about engineering and environmental decisions. For the most part, this involved levee construction and wetland destruction.

People with higher education seemed to learn more about engineering and environmental decisions. No other visitor characteristics were significantly related to this question; all parts of the audiences learned about the engineering and environmental decisions.

Did the exhibits help you understand the engineering and environmental decisions that contributed to the disaster or not really?

	(n=405)
yes	73%
not really	27%

Selected cross-tabulation		less than college (n=78)	college degree (n=148)	graduate school (n=179)
understand engineering better	**	60%	72%	**81%**
do not understand better		40%	28%	19%

Give an example that helped you understand the engineering and environmental decisions that contributed to the disaster:

44%	levee construction
13%	wetlands destruction
7%	canals, dredging, MRGO
3%	no disaster plan, not prepared, flawed evacuation plan
3%	didn't heed scientists' warnings that city was at risk
2%	homes built wrong, in wrong places
1%	pumping stations were not manned
1%	poor government response
1%	city below sea level
7%	other
7%	blank
27%	exhibits did "not really" help understand the engineering and environmental decisions

B.3 Understanding levee failures

OVERVIEW: Visitors were asked to identify the "primary reasons for the catastrophic levee failures" from a list of six plausible choices. Three were chosen by a majority of visitors and three were chosen much less often. The most frequently chosen items include the better explanations: levee construction, design of levee walls and storm surge.

Which of these are the primary reasons for the catastrophic levee failures?
[not presented in this order]

	(n=405)
poor quality of levee construction	78%
poor design of levee walls	71%
storm surge overwhelming levees and levee walls	66%
canal pumping stations not working	36%
water flowing over the top of levees	36%
the impact of high winds	23%

B.4 Understanding disaster preparedness

OVERVIEW: The large majority of visitors agree that government officials should have listened to scientists. This is even more true among people with a stronger emotional impact, members of environmental organizations, older adults and those with higher education.

On a scale of 1-5 — 1=do not agree at all and 5=agree completely — what do you think of this statement: The Katrina disaster wouldn't have been as bad if government officials had listened to scientists?

	(n=405)	
do not agree at all (1)	2%	
(2)	4%	
(3)	14%	
(4)	24%	
agree completely (5)	57%	} 81%

Selected cross-tabulations

		stronger emotional impact (n=255)	lesser emotional impact (n=149)
agree (4-5)	**	**88%**	68%
do not agree (1-3)		12%	32%

		environmental organization member (n=162)	not a member (n=241)
agree (4-5)	**	**87%**	76%
do not agree (1-3)		13%	24%

		age 18-44 (n=112)	age 45-64 (n=156)	age 65+ (n=137)
agree (4-5)	**	69%	**84%**	**85%**
do not agree (1-3)		31%	16%	15%

		less than college (n=78)	college degree (n=148)	graduate school (n=179)
agree (4-5)	**	68%	**81%**	**85%**
do not agree (1-3)		32%	19%	15%

	Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
agree (4-5)	82%	73%	81%	80%
do not agree (1-3)	18%	27%	19%	20%

B.4 Understanding disaster preparedness (continued)

OVERVIEW: About half of the people interviewed thought the information about disaster preparedness would be useful for a potential disaster where they live. This was somewhat higher among people with a stronger emotional impact, residents of the Gulf Coast and those 45-64 years of age.

On a scale of 1-5 — 1= not at all useful and 5= very useful — how relevant would you say the information in this exhibition would be for potential disasters where you live?[5]

	(n=405)	
not at all useful (1)	22%	
(2)	18%	
(3)	18%	
(4)	15%	} 43%
Very useful (5)	28%	

Selected cross-tabulations

		stronger emotional impact (n=255)	lesser emotional impact (n=149)
very useful (4-5)	**	**50%**	30%
not very useful (1-3)		50%	70%

		Louisiana residents (n=38)	Gulf Coast residents (n=26)	other U.S. residents (n=267)	non-U.S. residents (n=73)
very useful (4-5)	**	n/a	**72%**	40%	41%
not very useful (1-3)		—	28%	60%	59%

		age 18-44 (n=112)	age 45-64 (n=156)	age 65+ (n=137)
very useful (4-5)	**	35%	**54%**	35%
not very useful (1-3)		65%	46%	65%

[5] This question was not asked of residents of southeast Louisiana, therefore only six other Louisiana residents were asked this question.

B.4 Understanding disaster preparedness (continued)

OVERVIEW: Visitors who thought the exhibit provided very useful information (43% of the total from the question on the previous page) cited a wide variety of lessons about disaster preparedness. Most often they mentioned the importance of emergency preparedness, but also survival tactics, lack of reliance on the government or mentioning the types of disasters most common where they live.

What did you find out that might be useful or relevant for potential disasters where you live? **(asked of people from outside the New Orleans area)**

15%	importance of emergency planning, preparedness
7%	survival tactics, emergency kits (individual level)
5%	government response, don't depend on government
5%	we live near the coast; we get hurricanes so it's relevant
5%	we have earthquakes, tornadoes, storms
4%	we live near river/water, flooding
4%	evacuation, get out!
3%	listen to scientists, take action
3%	environmental issues / wetlands
3%	better levee systems
3%	importance of communications, coordination
1%	build strong, build high
4%	other
3%	blank
57%	[rated 1-3 "not very useful"]

C. Major Themes

This section reviews visitors' recognition and understanding of several major themes presented in the exhibition.

- **Visitors were more likely to recall thematic messages about the human impact of the Katrina disaster and descriptive aspects of the disaster** (the path and strength of the hurricane, the widespread flooding, etc.) **but somewhat less likely to recall the science themes.** Children followed a similar pattern: more likely to remember "people helping people" than anything about wetlands or levees. Strong emotional impact did not affect recall of the major themes but adults with children were somewhat less able to recall the major themes..
- **For the most part, visitors gave reasonable indications of having seen the major themes.** Those who said they saw a theme were mostly able to identify the room in which they saw it and give an example or explain something about it.
- **The weakest understanding was about "how people can better prepare for hurricanes" and "how ocean temperature affects the strength of hurricanes."** Few of the people who indicated they saw something about "how ocean temperature affects the strength of hurricanes" could articulate anything specific other than recalling seeing something about it.

C.1 Recognizing major themes

OVERVIEW: For the most part, visitors reported recognizing most of the interpretive messages: 11 of 14 interpretive messages were recognized by at least two-thirds of the visitors. Even the 3 of 14 interpretive messages that were recognized by fewer visitors were recognized by around half of the visitors. As a check on the visitors' recollections, a subsample was asked to identify where in the exhibition they saw that theme reflected. Those results are presented on the following page.

Here is a list of topics, for each one, tell me if you found out something about it in this exhibition.

	% selected	
Theme	**2/3 of sample (n=278)**	**1/3 of sample (n=127)**
What it was like in New Orleans during the flooding	98%	—
The human impact of storms like Katrina	—	96%
The individual people who helped rescue others from the flooding	—	94%
The path and strength of Hurricane Katrina	—	92%
How widespread the flooding was in New Orleans	—	89%
Problems with the emergency management response by the government	88%	—
The ways in which wetlands destruction made the disaster worse	—	86%
The ways in which wetlands protect where people live	83%	—
How levees are designed and built and how they fail	83%	—
Things that are being done to prevent disasters in the future	70%	—
Years before Katrina, scientists predicted a likely hurricane flooding disaster	68%	—
Why not everyone evacuated before the storm	—	62%
How people can better prepare for hurricanes	—	54%
How ocean temperature affects the strength of hurricanes	43%	—

Children were asked if they found out something about three topics. They found out something about people helping others to a great extent, and two-thirds of older children said they learned something about wetlands or levees. It is unclear how to interpret this because many of the children (especially older ones) said that they did not find out anything because they already learned about it in school.

find out something about	**older children**	**younger children**
people helping others	97%	73%
wetlands	66%	65%
levees	69%	55%

C.1 Recognizing major themes (continued)

OVERVIEW: After indicating that they had seen something about a theme, some visitors were shown an illustrated schematic map of the exhibition and asked to identify the room or rooms in which they saw that theme reflected. This is a strategy for testing people's answers… validating that when they say they saw/recognized a theme, they can back that up somehow. These results suggest that for the most part visitors could identify where they saw themes represented. The table below shows the responses of visitors who said they recalled seeing each theme.

For the most part, the responses accurately reflect the rooms in which the themes are most prominently presented. For example "the ways in which wetlands protect where people live" is primarily presented in Room 3.

There is some confusion in visitors' minds over some themes. "What it was like in New Orleans during the flooding" is presented only slightly in Room 1 by the attic exhibit but primarily it is in Room 2. It could be that some visitors are unable to differentiate the time period of the hurricane and that of the flooding. "Things that are being done to prevent disasters in the future" is mostly attributed to Room 3 (which actually addresses causes of disaster problems, but "preventing hurricanes" is more substantively presented in Room 4.

Only about one-half of visitors seem to actually recall the panel in Room 3 which presented quotes of predictions of a hurricane flooding disaster.

	In which rooms did you see that? (you can choose as many as apply)					
	Lobby	Room 1	Room 2	Room 3	Room 4	don't know
What it was like in New Orleans during the flooding	3%	**63%**	**60%**	16%	9%	5%
Problems with the emergency management response by the government	1%	7%	**75%**	**29%**	13%	4%
The ways in which wetlands protect where people live	0%	3%	3%	**93%**	4%	3%
How levees are designed and built and how they fail	0%	2%	3%	**88%**	4%	4%
Things that are being done to prevent disasters in the future	0%	0%	4%	**70%**	**32%**	8%
Years before Katrina, scientists predicted a likely hurricane flooding disaster	0%	26%	15%	**51%**	8%	13%
How ocean temperature affects the strength of hurricanes	0%	9%	2%	**89%**	2%	4%

C.1 Recognizing major themes (continued)

OVERVIEW: The table below demonstrates that emotional impact had no influence over recognition of the interpretive themes. None of the differences in this table are significantly different for people reporting different levels of emotional impact.

	% selected	
Theme	**strong emotional impact**	**lesser emotional impact**
What it was like in New Orleans during the flooding	97%	99%
The human impact of storms like Katrina	96%	96%
The individual people who helped rescue others from the flooding	96%	92%
The path and strength of Hurricanes Katrina	93%	90%
How widespread the flooding was in New Orleans	91%	86%
Problems with the emergency management response by the government	90%	85%
The ways in which wetlands destruction made the disaster worse	87%	84%
The ways in which wetlands protect where people live	83%	85%
How levees are designed and built and how they fail	83%	84%
Things that are being done to prevent disasters in the future	69%	72%
Years before Katrina, scientists predicted a likely hurricane flooding disaster	67%	69%
Why not everyone evacuated before the storm	65%	59%
How people can better prepare for hurricanes	54%	53%
How ocean temperature affects the strength of hurricanes	41%	46%

C.1 Recognizing major themes (continued)

OVERVIEW: The table below demonstrates some differences between parents visiting visitor groups with children and adults visiting without children. Those with children learned less about several of the themes, especially those that are more specific and require greater attention. Families are just as good at noticing themes in the science area — wetlands, levees and ocean temperature.

	% selected (adult interviews)	
Theme	**adult-only groups**	**family groups**
What it was like in New Orleans during the flooding	97%	100%
The human impact of storms like Katrina **	**97%**	86%
The individual people who helped rescue others from the flooding	95%	93%
The path and strength of Hurricanes Katrina **	**95%**	71%
How widespread the flooding was in New Orleans **	**91%**	71%
Problems with the emergency management response by the government **	**91%**	76%
The ways in which wetlands destruction made the disaster worse	85%	93%
The ways in which wetlands protect where people live	83%	85%
How levees are designed and built and how they fail ++	81%	93%
Things that are being done to prevent disasters in the future	68%	78%
Years before Katrina, scientists predicted a likely hurricane flooding disaster	67%	68%
Why not everyone evacuated before the storm **	**66%**	36%
How people can better prepare for hurricanes	54%	50%
How ocean temperature affects the strength of hurricanes	57%	66%

C.2 How Levees are designed and built and how they can fail

OVERVIEW: A subsample of visitors was asked to elaborate on what they found out about some of the themes they recalled from the exhibition. Results on these six pages show that high proportions of visitors recognized four of the themes, and that half to three-quarters of the visitors could describe any content about five of the six themes.

With regard to "how levees are designed and built and how they can fail," visitors mentioned a wide variety of things they learned. The most frequent responses included how the levees were built (poorly, with sand rather than clay, I walls, not deep enough) and the ways in which they failed (overtopping, undercutting etc.).

Percent recognized: **83%** (effective learning: 69%)

What did you find out about how levees are designed and built and how they can fail?

14%	how they were built, poorly constructed
10%	how they failed, where water came from, water went over/under
9%	clay is better than sand, types of soil
8%	T vs. I model, T is better
7%	multiple ways they can fail
7%	they weren't deep enough
6%	they need to be fixed, new plans for the future
5%	old, eroded, not maintained
4%	government failure, they knew and didn't do anything
3%	interesting, well done, liked visuals and interactive
1%	nature is too strong, engineering can't beat it
6%	other
2%	nothing much, already aware
12%	blank, don't know, didn't understand it
17%	didn't recognize this theme

C.3 Ways in which wetlands protect where people live

OVERVIEW: Visitors who recognized the theme "ways in which wetlands protect where people live" most often mentioned that wetlands are natural storm buffers, swamps being destroyed for canals, and the loss of wetlands.

Percent recognized: **83%** (effective learning: 65%)

What did you find out about ways in which wetlands protect where people live?

22%	natural storm buffer, water barrier, absorb water
13%	cypress swamps (wetlands) were destroyed by levee/canal builders
11%	loss of wetlands, how fast they are being lost
7%	the interactive with the balls (no details about what they learned)
7%	wetlands are important, need to protect
3%	how to recover wetlands
2%	how the damaged wetlands failed to protect
1%	videos, map
6%	other/unclear
3%	nothing new, already aware
15%	blank, don't know, didn't really stop
17%	didn't recognize this theme

C.4 How ocean temperature affects the strength of hurricanes

OVERVIEW: One section of Room 3 (all visitors did not stop there) describes in a panel and an interactive "how ocean temperature affects the strength of hurricanes." A small portion of visitors could elaborate on this idea beyond restating it.

Percent recognized: **43%** (effective learning: 29%)

What did you find out about how ocean temperature affects the strength of hurricanes?

15%	warm water makes storms stronger
4%	saw simulation model/video
3%	something about climate change
3%	something about the depth of water
1%	larger storms, more frequent storms
2%	temperature plays a role (but didn't articulate)
3%	other/unclear
4%	nothing, already aware
10%	blank, don't know
57%	didn't recognize this theme

C.5 The ways in which wetlands destruction made the disaster worse

OVERVIEW: Visitors who recognized the "ways in which wetlands destruction made the disaster worse" were able to articulate several ideas and observations related to this theme. Most frequently, visitors mentioned that wetlands are natural buffers that were compromised by runoff, building, canals and nutria.

Percent recognized: **86%** (effective learning: 74%)

What did you find out about ways in which wetlands destruction made the disaster worse?

22%	natural buffer, couldn't completely absorb surge
17%	how runoff, nutria and housing affects wetlands
14%	how levee/canal construction destroyed wetlands
9%	interactive with balls showed it
4%	wetlands are important
4%	map showing NOLA position below sea level
3%	video
2%	how to revive wetlands, future 2050
10%	other / unclear
3%	nothing new, already aware
9%	blank, don't recall
14%	didn't recognize this theme

C.6 Why not everyone evacuated before the storm

OVERVIEW: Visitors cited many reasonable examples of "why not everyone evacuated before the storm," they felt safe, lack of resources and transportation, elderly or sick.

Percent recognized: **62%** (effective learning: 49%)

What did you find out about why not everyone evacuated before the storm?

14%	felt safe, didn't realize it was so bad
9%	economics, poverty
9%	no transportation
6%	elderly, sick
6%	pets
6%	they couldn't leave (unspecified reasons)
5%	didn't have access to information
5%	no time
2%	no place to go, no shelter, only the Superdome
5%	other
13%	blank, don't know
38%	didn't recognize this theme

C.7 The path and strength of Hurricane Katrina

OVERVIEW: "The path and strength of Hurricane Katrina" are illustrated in several parts of the exhibition including Room 1 and Room 3. Some people cited videos which showed the path and others mentioned facts that they learned: it increased in strength quickly, the destruction, other places it hit, changing direction and others.

Percent recognized: **92%** (effective learning: 82%)

What did you find out about the path and strength of Katrina?

21%	watched the video, timeline, path
20%	it increased in strength quickly
14%	focus on the destruction, aftermath
13%	named places where it hit, Bahamas, Florida, Mississippi
8%	it changed directions suddenly
7%	it was a huge storm
9%	magnitude of storm, very strong
6%	mentioned something in Room 3
4%	other
10%	blank, don't know
8%	didn't recognize this theme

D. Characteristics of the Summative Evaluation Sample

This section presents information about the people interviewed for the summative evaluation presented in Sections A-C.

D. Characteristics of the Summative Evaluation Sample

OVERVIEW: The sample of visitors interviewed for the summative evaluation represents a reasonable cross-section of the audience for the Louisiana State Museum. Few visitors are local: most of the visitors are from states outside the Gulf Coast and other countries, and few were directly affected by Hurricane Katrina. The age distribution is very diverse. Women account for more than half of all visitors and college graduates constitute the majority of visitors. Families account for a small proportion of visitor groups and somewhat less than half belong to or give money to an environmental organization.

	all visitors (n=405)	directly affected (n=34)	indirectly affected (n=140)	not affected (n=230)
Home residence:				
Louisiana	9%	65%	5%	4%
other Gulf Coast states	6%	18%	10%	3%
other states	66%	15%	70%	71%
other countries	18%	3%	15%	22%
Age:				
18-24	9%	0%	5%	12%
25-34	19%	18%	15%	22%
35-44	16%	21%	20%	13%
45-54	23%	27%	28%	19%
55-64	21%	23%	18%	22%
65+	13%	12%	15%	12%
Gender: women	60%	53%	61%	61%
men	40%	47%	39%	39%
Education:				
high school	8%	6%	8%	8%
some college	11%	27%	10%	10%
college grad	37%	44%	34%	37%
graduate school	44%	24%	47%	45%
Group type:				
adult-only	86%	72%	85%	89%
families with children	14%	28%	15%	11%
Environmental organization:				
member/ give money	40%	29%	41%	41%
not	60%	71%	59%	59%
Affected by Katrina:				
directly	8%	100%	—	—
indirectly	35%	—	100%	—
not	57%	—	—	100%

Science Focus: Mini-studies of Room 3, "What Happened?"

E. Study #1: Observed Behaviors – Summary of Findings

This mini-study uses data based on observations of 72 visitors during their time in Room 3: "What Happened?". For each visitor their times entering and exiting the room were recorded along with each of the individual exhibits they engaged with for five or more seconds. Some visitors were observed leaving the room and returning a few minutes later — the total time and exhibits were recorded as one visit to this room. Visitors were not interrupted and did not appear to know they were being observed.

Time spent in Room 3: Some of the visitors just glanced around the room and walked through, while most visitors spent some time looking, listening, manipulating or otherwise using exhibits. On average, visitors spent just under nine minutes in this room although there was a great deal of variation in how much time people spent here (few spent 8-9 minutes).

Exhibit engaged: Most visitors engaged three or more exhibits in Room 3 with an average of about 5 exhibits used per visitor. Very few visitors walked through the room without engaging any of the exhibits and some engaged nearly all of them.

Emphasis on the beginning and end: The shortest way through the room passes by the We Knew panel, levee break video, around the corner of the wall and through the Wetlands and Land Loss area. Five of the six most-used exhibits are along this path. The Levee Break video grabs almost everyone's attention and often becomes a bottleneck of circulation. The wetlands interactive is the largest interactive with three separate table top models somewhat resembling pinball machines. The exhibits farthest from this shortest path through the room (the Disaster Management area) are among the least utilized.

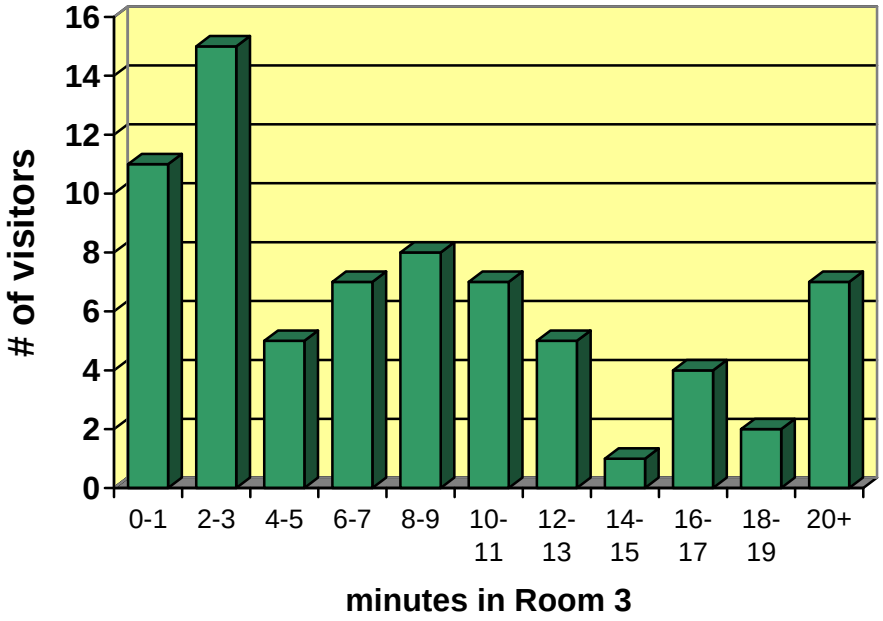
Types of interactives used: Visitors were more likely to use the mechanical interactives rather than the computer interactives — about two-thirds used one or more of the four mechanical interactives and about one-third used one or both of the two computer interactives. Part of this discrepancy might be due to the placement of the wetlands interactive on the shortest path through the room, and that both of the two computer interactives were away from that path (perhaps facilitating longer use, but by fewer people).

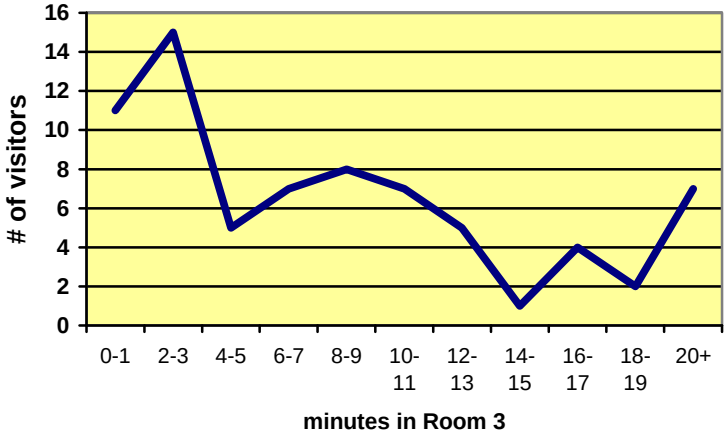
Types of media used: People who used the videos are also more likely to read the major wall panels. It seems that some people are interested in depth of information while others only want superficial exposure to the information presented in Room 3.

E1. Time spent in the Room 3

OVERVIEW: Visitors varied in how much time they spent in Room 3 — 11 of the 72 people observed spent one minute or less there while 7 spent twenty minutes or more. On average, visitors spent 8.6 minutes in this room.

	(n=72)
average # minutes in Room 3	8.6
standard deviation	7.8

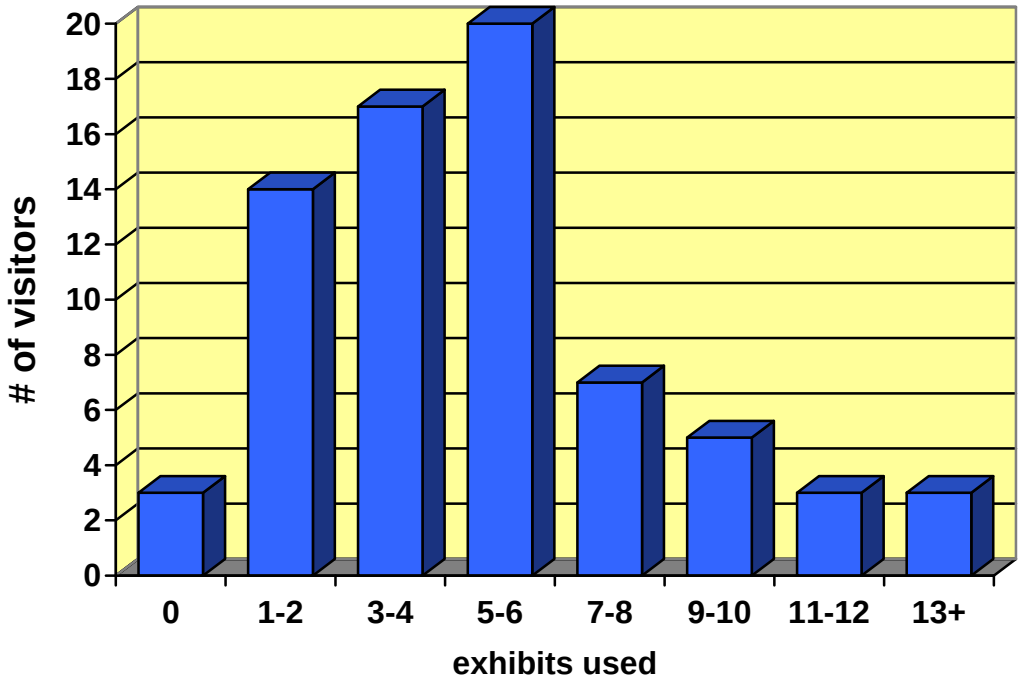




E2. Patterns of exhibit usage

OVERVIEW: Most people were observed to use (read, manipulate, listen to, view) between one and six exhibits. A few people spent some time at almost all of the individual exhibits. The average and median (half of visitors above and half below) number of exhibits engaged is approximately five.

This pattern of use is consistent with the average time in the room being 8.6 minutes. The table on the next page shows the usage of the individual exhibits.



average # exhibits used	5.1
median # exhibits used	5

E2. Patterns of exhibit usage (continued)

OVERVIEW: The most attended exhibits are primarily those at the entrance and on the shortest path through Room 3. The levee break video is the first exhibit that most visitors notice upon entering the room. Along with being visually interesting and presenting audio with compelling stories, it answers a question that many visitors have: where did the water come from? The two other exhibits at the entrance (levee model and "We Knew" quotes panel) are also among the most used. The exhibit area nearest the exit and along the shortest path through Room 3, "Wetlands and Land Loss" (wetlands interactive, wetlands/scientist video, wetlands panel) is the most used of the comparable exhibits in the other three sections of Room 3.[6]

Visitors used the rest of the exhibits at roughly equal levels — approximately 20-25% of visitors used any particular exhibit. Having no interactives and being the farthest from the entrance and exit, the Disaster Management sector received the least attention.

exhibit element	usage
levee break video	86%
wetlands interactive	54%
we knew quotes panel	42%
levee model	42%
levee engineering panel	36%
wetlands/ nutria video	32%
wetlands/ scientist video/ panel	25%
hurricane science panel	25%
hurricane science video	22%
levee soils interactive	22%
levee failure computer	22%
levee depth interactive	21%
hurricane path computer	21%
levee walls interactive	19%
disaster management panel	18%
levee engineering video	14%
disaster management video	13%

Levee break video

Wetlands interactive

[6] The "We Knew" panel is not comparable because it does not contain the in-depth scientific information found in the main panels of the four areas: levees, hurricane forecasting, emergency management and wetlands. Each of these major sectors of the room also has a more technical video with handheld audio that is very different from the levee break video.

E3. Types of exhibits used

OVERVIEW: Each of the four major sectors of the science room called "What Happened?" – Levee Engineering, Hurricane Science, Disaster Management, Wetlands and Land Loss – has an in-depth wall panel and a video with a handheld audio device. In addition, Levee Engineering has several mechanical interactives and one computer-based interactive; Hurricane Science has one computer interactive, and Wetlands and Land Loss has a mechanical interactive and a video without voice-audio.

Visitors were more attracted by mechanical interactives than wall panels, computer interactives or videos, with approximately 70% using at least one mechanical interactive (often the wetlands interactive). However, most visitors did read something from one or more of the wall panels, about half watched and listened to one of the videos with handheld audio, and about one-third of the visitors used one or both of the computer interactives.

major wall panels
(levee engineering, hurricane science, disaster management, wetlands)

none	38%
looked at one	36%
two	14%
three	11%
four	1%

videos with handheld audio device
(levee engineering, hurricane science, disaster management, wetlands)

none	53%
watched one	28%
two	14%
three	4%
four	1%

computer interactives
(hurricane path and levee failure)

none	65%
used one	26%
two	8%

mechanical interactives
(levee depth, levee soils, levee walls, wetlands table)

none	31%
used one	44%
two	11%
three	6%
four	8%

E3. Types of exhibits used (continued)

OVERVIEW: The table below indicates that there is not an either/or preference for reading panels or watching videos. Instead people seem engaged in learning from multiple media or not very interested in learning at all.

		# of major panels read	
		none (n=27)	1 + (n=45)
number of videos watched			
none	**	**23**	15
1+		4	**30**

Asterisks ** indicate statistically significant differences ($p<.05$).

F. Understanding Hurricane Science: Room 3 Mini-study #2

Summary of Findings

This mini-study uses data based on interviews of 30 visitors as they left the Hurricane Science area. Only visitors who were observed to be engaged with exhibits for three minutes or more were approached for an interview. The major findings from this area are:

Gaining new information: About two-thirds of the visitors who spent time with the exhibits in Hurricane Science (20 of 30) said that they found out new information about "the science of hurricanes." Five of the six Louisianans interviewed said they learned nothing new and this seems possible if visitors just lightly skimmed the panel, video or computer interactive. It seems unlikely that almost any visitors could fully engage this area and not learn something new, although one-third said they didn't find out anything new. Those who did find out something new, mentioned characteristics of hurricanes, how they form, the impact of warm ocean water and the danger of storm surge.

Use of the storm path computer interactive: The storm path computer interactive was used by about half of the people who spent time in the Hurricane Science area. Mostly people understood that the interactive presented the wind speed and path of Katrina and others noted the damage to the animated house by high winds. Some got the more technical lesson that hurricane strength increases over warmer ocean water.

Use of the hurricane science video: Most of the visitors (63%) who spent time in the Hurricane Science area listened to an audio/video presentation. The information they reported learning ranged from superficial to more substantial: observations about forecasting errors and the impact of warm water on hurricane strength.

Clearly recognizable messages: After asking about top-of-mind learning, visitors were presented four themes from hurricane science and asked which they recognize from the exhibits. Two of the themes were recognized by most visitors:

- Storm surges caused much of the flooding after Katrina
- Warm sea surface temperatures cause hurricanes to strengthen

F1. New information learned

OVERVIEW: Visitors who were observed spending three or more minutes in the Hurricane Science area were approached as they left this area and asked questions about their experience. The first question asked about what the visitor found out in this area about "the science of hurricanes."

Two-thirds of the visitors (20 of 30) said they did learn something new and provided content in answering this question – they were most likely to mention learning about some characteristic of hurricanes or how they form. A few mentioned the impact of warm ocean water on the strength of hurricanes or the danger of storm surge.

One-third said they didn't learn anything new (including 5 of 6 Louisianans) — mostly indicating that they already knew this information. It's unlikely any individual knew everything presented in this area, but their claims of no knew knowledge might reflect general familiarity or cursory examination of these exhibits.

We're especially interested in what people find out about the science of hurricanes. Can you tell me two things you found out about hurricane science that you didn't know before today?

Characteristics of hurricanes

How big they are--150 miles wide; how categories work
Different levels of hurricane, 1-5, can go a long time, bigger and stronger by level
How massive: 450 miles wide
Columns of warm air, sheer size and strength of hurricanes
Categories; speed of wind, strength of hurricanes
Different levels of hurricanes, beginning at level 1
Different categories of hurricanes, what makes cat 1 and cat 5
How warm the water was; depth of the ocean
Damage from wind speed
How towers; hurricane paths - number of hurricanes in pacific
Hurricanes affect water deep- has to because how fast wind blows above

How hurricanes form

How they form in the gulf
Heat/warm water, depth of water helps make them form
How developed by turning water over in Gulf
How quickly they can develop
How a storm becomes a hurricane
Sea movement and how hurricanes begin
Currents where hurricanes come in along gulf coast and how frequently
How fast winds can progress

[categories of answers continue on the next page]

F1. New information learned (continued)

Warm water increases storm intensity

Warm and deep water provides energy for hurricanes
Warm water causes hurricanes to intensify
Hot water and air helps the hurricanes grow and surge
Hurricane becomes bigger when over warm water
Warm water big impact on hurricanes; most hurricanes in Louisiana because of the Gulf

Surge is dangerous

Surge is the worst part of hurricanes
Surge power of hurricane is most destructive, people are injured from surge
The deadliest part is the surge
Hurricanes affect storm surge

Forecasting was off

Forecasting models were all off initially
Hurricanes are difficult to forecast

F2. Use of the storm path computer interactive

OVERVIEW: Of the people interviewed about the Hurricane Science area, about half indicated that they had used the hurricane path computer interactive. They understood the interactive to show 1) wind speed and the path of Katrina, 2) impact of wind on the structure and 3) how hurricanes and ocean water interact.

This interactive is related to hurricanes. Did you spend any time using or observing it?

yes	60%
no	40%

What would you say that interactive was trying to demonstrate?

Wind speed and path of the hurricane

Following wind velocity and path of hurricane
Path and strength of hurricane and when it hit land
Showed pattern as hurricane moved through gulf and changed categories
Tracking, force of wind was great
Effect of hurricanes, how fast they can build, winds, different categories
Showed wind speed and path of hurricane
Path of hurricane, depth of hurricane over the Gulf, speed of wind in relation to categories

[categories of answers continue on the next page]

F2. Use of the storm path computer interactive (continued)

Impact of wind on the house

How wind velocity impacts houses
Structures affected as speed and category increases
Velocity, picks up speed, now house ripped apart at different categories
Damage caused by different categories, like the house
How hurricanes develop (category 1-5) and how hurricane destroyed the building
Force and power of hurricane; devastation caused by increased velocity of wind
Damage caused on the house by speed of wind

Interaction with ocean water

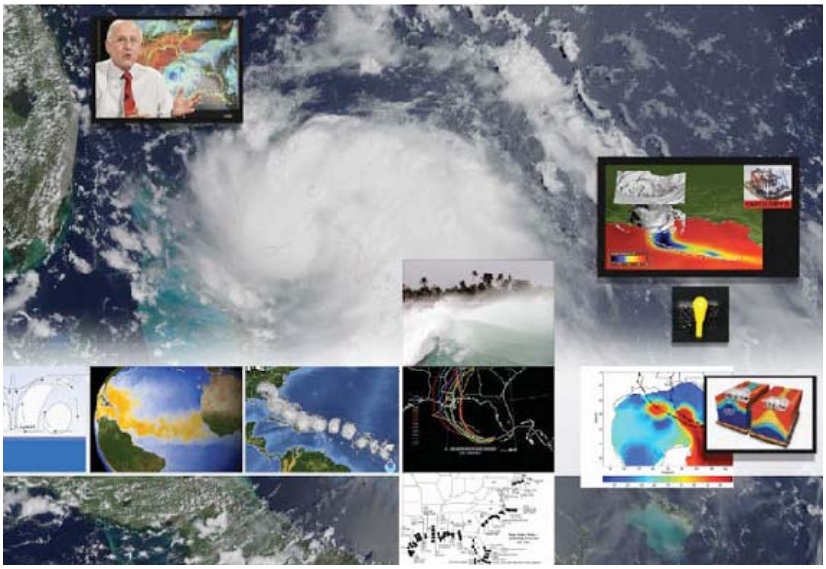
How hurricanes increase over warm water,
How hurricane advances to heat the ocean,
Saw the presence of the sea - variation of environment as hurricane moves
Bringing up water from down below to make hurricane stronger
What wind speed and water temperature does for acceleration of hurricanes

Other

Not sure
How the hurricane begins and develops

F3. Use of the Hurricane Science video

OVERVIEW: Most of the visitors (63%) who spent time in the Hurricane Science area listened to the audio-video presentation and other videos as well. Some made observations about forecasting errors and others learned about the impact of warm water on hurricane strength. Some didn't learn anything new or else they made superficial observations about Katrina being a big storm.



Here in this room, did you watch any of the videos with handheld audio? / Which ones?

yes, Hurricane Science	63%
yes, others	60%
none	27%

What did you find out about the science of hurricanes in that video?

Warm water increases severity of hurricane

Gets more force if warm water temperature, spins counter-clockwise around Gulf
Warmer and cooler – shows heat makes the strength of hurricanes increase
How they develop from a depression, when they hit warmer water in gulf then increase in speed, then develop into cyclical turning pattern
"Red tower" where energy comes from
Water depth and temperature

Forecasting models were incorrect

Talking about how hurricane was tracking up, missed city and hit the 9th ward
Forecasting models were all off initially
How fast storm approached, forecast was very off, size and magnitude of hurricane
Hurricane Katrina was first modeled to go to the Panhandle
How it was tracked

F3. Use of the Hurricane Science video (continued)

It was a big storm

Going to be a bad storm
How big the hurricane was
Winds, wind pattern for hurricane to grow into category 5

Other

Surge is dangerous because people think it's over; east side is worst side of hurricane

Nothing new

Nothing new, already knew it all from watching weather and living through hurricanes
Nothing new
Same stuff as watched on TV live, made me remember
Nothing
I only watched for a minute

F4. Recognizing themes

OVERVIEW: Visitors were shown four "themes" related to hurricane science and asked which they recognize seeing in the science room. Almost all visitors (93%) said they saw "Storm surges caused much of the flooding after Katrina" and most said they saw "Warm sea surface temperatures cause hurricanes to strengthen" (80%) and "The loop currents caused the rapid intensification of Hurricanes Katrina and Rita" (67%). About half (53%) said they saw something about "Forecasters are more accurate in predicting a hurricane's path than they are in predicting hurricane strength" which was only presented in the video part of the Hurricane Science area.

Just based on what you saw in this room, which of the following themes did you see represented?

Storm surges caused much of the flooding after Katrina (content presented in the video)	93%
Warm sea surface temperatures cause hurricanes to strengthen (content presented in the panel, video, interactive)	80%
The loop currents caused the rapid intensification of Hurricanes Katrina and Rita (content presented in the interactive, video, panel)	67%
Forecasters are more accurate in predicting a hurricane's path than they are in predicting hurricane strength (content suggested by the video)	53%

F5. Characteristics of the sample: mini-study #2

Home residence:	n=30
Louisiana	6
other United States	19
other countries	5
Age:	
18-24	3
25-34	4
35-44	4
45-54	7
55-64	9
65+	3
Gender:	
women	15
men	15
Education:	
some school	1
high school	2
some college	4
college grad	16
graduate school	7
Personally impacted by Katrina	
yes, directly	6
yes, indirectly	7
no	17
Emotional impact of exhibit	
moderate	4
a great deal	11
extremely strong	15

G. Understanding Levee Engineering: Room 3 Mini-study #3

Summary of Findings

This mini-study uses data based on interviews of 30 visitors as they left the Levee Engineering area. Only visitors who were observed to be engaged with exhibits for three minutes or more were approached for an interview. The major findings from this area are:

Gaining new information: The Levee Engineering area appears to be very effective in imparting new information to visitors who seek out this area. Almost all of the visitors who spent time with the exhibits in Hurricane Science (28/30 and all four Louisianans interviewed) said that they learned new information about "levee design and construction." The most frequently cited lessons were that "Clay is a better foundation than organic soils," "Levees must reach low enough" and "the 'T' design works better than the 'I' design."

Use of the Levee Engineering interactives: Of the four interactives in this area, the most frequently used were "levee soils" and "levee failure." For each of the interactives, visitors seemed to gain some reasonable understanding of its purpose.

Use of the Levee Engineering video: Slightly fewer than half of the people who spent time in this area stopped to watch and listen to the video. Those that did so seemed to gain a variety of information, most commonly that the levees were poorly designed.

Clearly recognizable messages: After asking about top-of-mind learning, visitors were presented four themes from Levee Engineering and asked which they recognized from the exhibits. All four of the themes were recognized by most visitors:

- Levee failures can have many causes
- Some soils are better suited than others for holding levee walls
- Some levee failures in New Orleans were caused by poor construction methods
- Some designs of levee walls are stronger than others

G1. New information learned

OVERVIEW: The people who spent time in the Levee Engineering area of Room 3 gained a number of different insights, but foremost was that clay is a better foundation material for levees than organic soils.

We're especially interested in what people find out about the engineering of levees. Can you tell me two things you found out about levee design and construction that you didn't know before today?

Clay is a better foundation than organic soils

Materials-clay vs. organic
Use clay for earthen levees not organic soil
Material - clay better than organic material
Materials for levee were organic soils
Stability issues with materials
Composition of land and water seeping underneath
Need hard clay not organic material
Soil, dense clay versus organic soil
Density of soil is an issue;
Used clay to build levees
Importance of sheet going down into clay;
Composition of soil and effect
Dense versus soft soil
Optimal materials are clay for building;
Don't build on organic soil
MRGO soil was made of poor soil, not clay
Composed of earth which can wash away

[categories of answers continue on the next page]

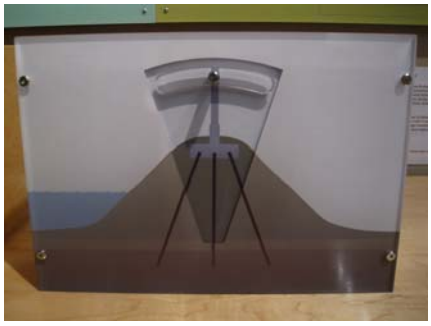
G1. New information learned (continued)

Levees must reach low enough

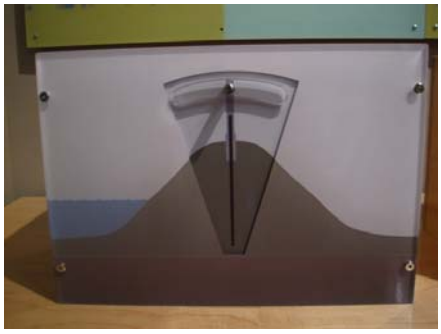
Need deep enough levees
Depth of steel placed into the ground
Water can seep under if wall isn't deep enough
Depth of barriers is important
How levees slid with the sheet pile if not deep enough
Water can seep through and under levees
Part that's underground allowed seeping underneath

The "T" design works better than the "I" design

"T" shape construction adds stability
They could have done better -- used "T" instead of "I"
Difference between "I" and "T" construction
How the "T" system works
"T" shape is stronger
Levees need to be anchored appropriately



"T" levee model



"I" levee model

Levees can fail in many ways

Natural things that cause levees to break
All the ways levees can fail
How they breached
Trees and debris can be detrimental to levees

Levee failures during Katrina

Levee engineering and failures led to flooding being worse
Levees broke in many places
*In New Orleans, the flooding and issues getting it [*the water*] out*
Wall used to prevent flooding and why it failed during Katrina

Levees need to be high enough

How high the levees needed to be
Short tops led to topping over
Importance of the top being high enough

G1. New information learned (continued)

Materials used

Levees made of strips of metal
Made of steel sheets; complicated: one area affects another area
What they use-steel beams

Various levee designs were used

Different designs in different places
Poorly designed; various designs

Unfinished work after Betsy

Levees hadn't been finished after Betsy
Lack of construction after Betsy

Nothing

Nothing
No, I studied engineering

G2. Use of levee interactives

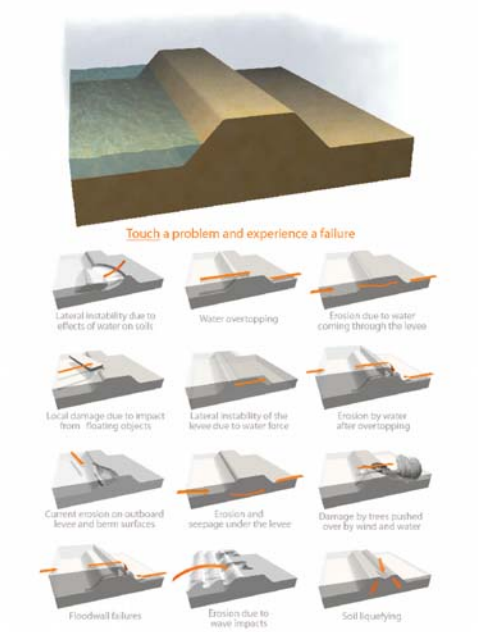
OVERVIEW: Almost all of the people who passed through the Levee Engineering area used at least one of the interactives in that area. Of the four levee interactives, visitors in this area were most likely to use the levee soils and the levee failure. Approximately half used the levee walls and half used the levee depth interactive.

Which [levee interactives] did you spend time using or observing?

levee soils	73%
levee failure	70%
levee walls	53%
levee depth	43%
none	3%

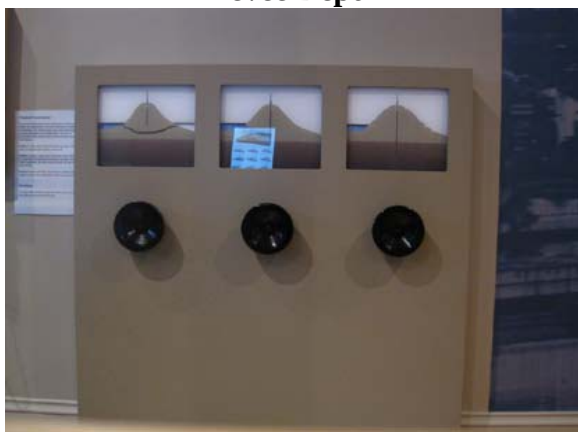
Levee Soils

Levee Failure



Levee Walls

Levee Depth



G2. Use of levee interactives (continued)

OVERVIEW: For the most part, people using these interactives gained some reasonable information from it — the importance of the type of soil used for levees, the several ways levees can fail, difference between "I" and "T" walls, and the importance of the depth of the wall.

What would you say that interactive was trying to demonstrate?

Levee soils

Effect of soil on strength of levees
The stability of materials in levees, clay
Issues with the type of soil used
How the soil is loose or tight
Difference in material of levees not right and get movement
Dense clay helped barrier stay up
One showed poor soil allowed movement
The density of the clay can hold the levee, organic would wash away
Not a clue

Levee failure

Different kinds of breaks
How water went over the top of levees
There are different ways a levee can breach
How levees break down
How different aspects led to structural failure
Different types of impact and effect on levees
How levees fail, seeping through

Levee walls

"I" levee doesn't go down deep enough so it moves - has too much give, "T" levee has more support
The strength of "T" walls over "I" walls
Stability based on how it's anchored in soil
The way water hit it and moved the levee over
If not enough foundation in wall it won't work
Stronger to use "T" versus "I" because it doesn't move as much
Depth of metal component affected levee effectiveness
How the sheet piles can fail- moving back and forth
T shape is stronger and more resistant to floods

Levee depth

Affects of different types of levees and their flaws
Different types of levee systems, how they work and possible problems
The importance of central plate down to clay

G3. Use of the Levee Engineering video

OVERVIEW: Almost half of the visitors to this area stopped to watch and listen to the Levee Engineering video. Those that did recounted something about the reasons for levee failures.

Here in this room, did you watch any of the videos with handheld audio? / Which ones?

levee engineering	40%
others	40%
none	50%

What did you find out about levees in that video?

Depth of steel placed into the ground; clay better than organic soil
What the Corps of Engineers produced and it was insufficient
How the walls were constructed
Poor design of levees
This could have been prevented; they were designed poorly
Materials and methods of levee building, different ways levees fail
Need to use clay material
The 17th street and London Avenue breaches and why
How overarchingly the federal levee system failed
Design flaws and how they breached
Organic soil used originally, how we didn't know organic soil would settle
MRGO used soil not clay

G4. Recognizing themes

OVERVIEW: Visitors in the Levee Engineering area reported recognizing several of the themes presented there. All but one person indicated that they saw "levee failures can have many causes" and most visitors saw something about the other themes also.

Just based on what you saw in this room, which of the following themes did you see represented?

Levee failures can have many causes (content found in video, touch screen, panel)	97%
Some soils are better suited than others for holding levee walls (content found in soils interactive, levee depth interactive, video)	87%
Some levee failures in New Orleans were caused by poor construction methods (content found in levee walls, panel, video)	87%
Some designs of levee walls are stronger than others (content found in levee walls and depth interactives, video)	77%

G5. Characteristics of the sample: for mini-study #3

Home residence:	n=30
Louisiana	4
other United States	22
other countries	4
Age:	
18-24	9
25-34	4
35-44	6
45-54	5
55-64	4
65+	2
Gender:	
women	21
men	9
Education:	
some school	1
high school	2
some college	7
college grad	11
graduate school	9
Personally impacted by Katrina	
yes, directly	5
yes, indirectly	3
no	22
Emotional impact of exhibit	
none	2
a little	2
moderate	7
a great deal	11
extremely strong	8

H. The Impact of Emotion on Science Learning: Room 3 Mini-study #4

Summary of Findings

This mini-study uses data based on the observation and very brief interview of 78 visitors during their time in Room 3. For each visitor their times entering and exiting the room were recorded and then the visitor was approached and asked two questions. The goal of this mini-study was to test the impact of emotion and selected demographic characteristics on the degree to which visitors engage with scientific learning. The amount of time spent in Room 3 is used to measure the engagement in science learning. The major findings are:

The relationship of emotion to engaging in science learning opportunities: Regardless of the self-reported emotional impact of Living with Hurricanes before Room 3, visitors spent approximately the same amount of time in Room 3. The same was true for the visitors' ages, gender and residence.

H1. Impact of emotion and characteristics on time spent

OVERVIEW: At the beginning of this research we hypothesized that time spent in the science room would be correlated with the emotional impact of the earlier parts of the exhibit. In addition, some visitor characteristics might be related to both time spent and emotional reaction: Louisiana residence, age and gender.

Among the figures below, the average time spent in Room 3 was not statistically significantly different when comparing people's emotional reaction or demographic characteristics recorded for this mini-study.

average # minutes in exhibit room 12.1 (among these 78 visitors)

	Emotional impact of overall exhibition	
	Low/medium (n=32)	high (n=46)
mean # minutes in exhibit room	10.9	12.9

	residence	
	Louisiana (n=17)	elsewhere (n=60)
mean # minutes in exhibit room	11.1	12.3

	men (n=30)	women (n=48)
mean # minutes in exhibit room	11.5	12.4

	age 18-39 (n=43)	age 40+ (n=34)
mean # minutes in exhibit room	11.9	12.5

H1. Impact of emotion and characteristics on time spent (continued)

OVERVIEW: The table below shows the results of a regression analysis on the amount of time visitors spent in the science room. Even when controlling for the effects of other variables, emotion and the other characteristics still had no discernable impact on the time spent in the room.

Regression analysis of emotion and other characteristics on time spent in the exhibit room:

Dependent variable: # of minutes a visitor was observed in the science room

Independent variables	coefficient	std. error	significance[7]
constant	5.875	7.171	.415
Age	.470	1.669	.779
Gender	.927	2.013	.646
Emotional impact	.461	0.503	.362
Louisiana residence	1.165	2.335	.619

[7] Significance below .05 would indicate a statistically meaningful impact on time spent in Room 3.

H2. Characteristics of the sample

Home residence:	n=78
Louisiana	22%
other United States	65%
other countries	13%
Gender:	
women	62%
men	38%
Estimated age:	
18-39	56%
40-59	38%
60+	7%