

Gallery of California Natural Sciences
Oakland Museum of California
Summative Evaluations

Serrell & Associates
August 2014



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**Final Report of the Summative Evaluations
of the
Natural Science Gallery at the Oakland Museum of California**

Serrell & Associates

August 2014

INTRODUCTION

This final report summarizes the findings from three summative evaluation activities conducted by Serrell & Associates and the Oakland Museum of California with visitors to the newly renovated, reinstalled, and reinterpreted Natural Sciences Gallery in April and July 2014: the stay-time study (ST), the cued questionnaire study (CQ), and the personal connections study (PC).

The Natural Sciences Gallery is a 25,000-square-foot area that begins with an introductory area, includes seven main sections (Oakland, Sutter Buttes, Mt. Shasta, Yosemite, the Tehachapis, Coachella Valley, and Cordell Bank), plus a “Futures Lounge” and a changing exhibits area that housed “Inspiration Points,” a landscape display, during the period of the summative evaluations.

The main findings for each study will be presented separately in the first three sections. The methods will be discussed briefly for each section, and the complete protocols for each of the methods are contained in Appendix 1. Comparisons of visitors’ background data for all three studies and comparisons of time spent from the ST and CQ studies will be in Section 4. The conclusions will be reviewed and discussed in Section 5.

The overall questions that were investigated in the summative studies included: How long did visitors stay in the exhibition? Where did they go? What did they remember? How and where did they make personal connections with nature? What did they think the exhibits were about? Did they notice the exhibits about human impacts on nature? What new things did they learn? To what degree did their feedback align with the goals of the exhibit planners?

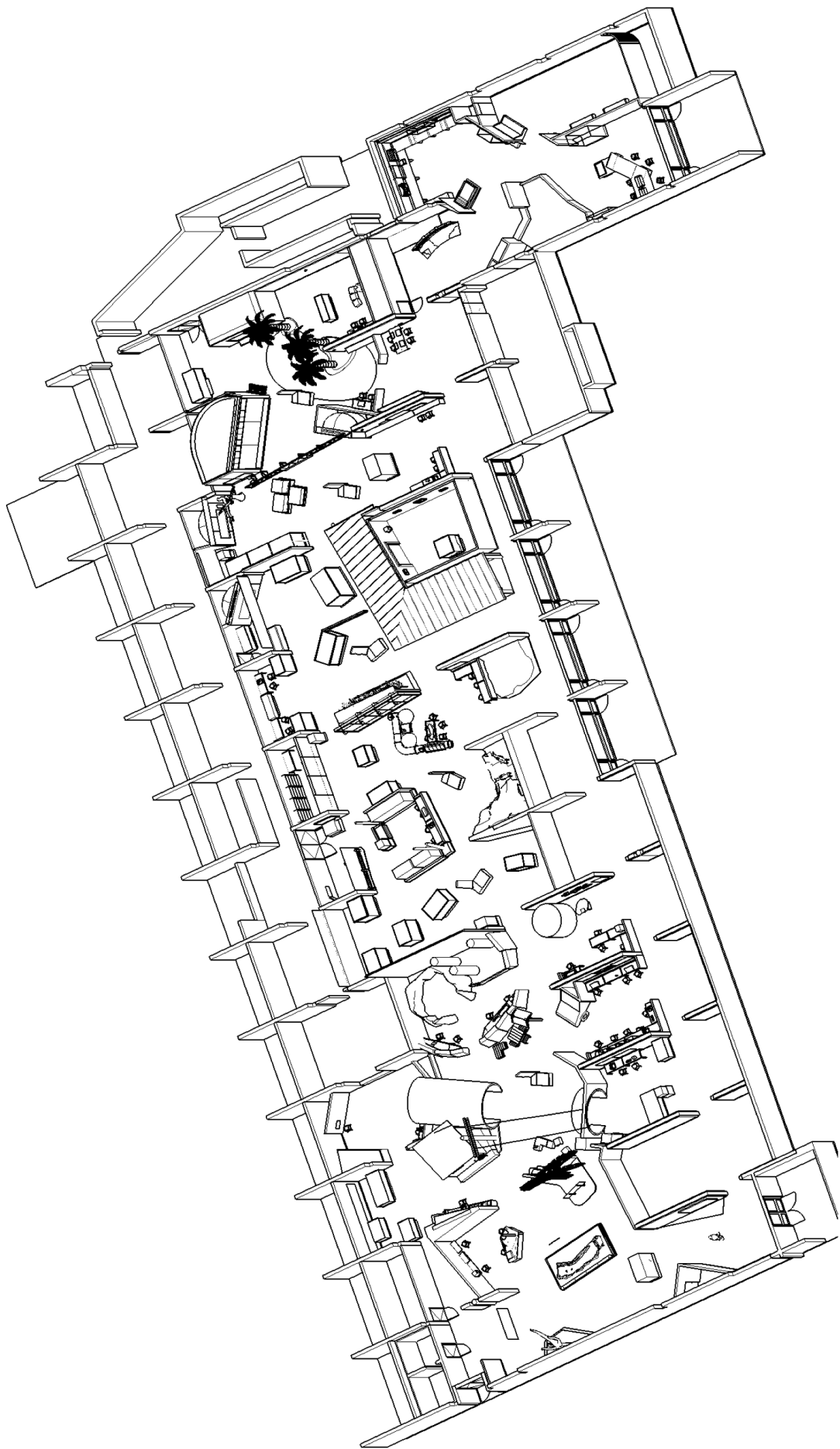
Rationale and limitations

Limitations for this study include issues regarding the schedule and issues regarding analysis of open-ended data. We had originally proposed to do a tracking-and-timing study with a sample of 100 visitors in the Natural Sciences Gallery (NSG), but the exhibits were not ready until April 2014, which presented two problems. As a method for gathering data on visitors’ overall experiences, observations of visitor behavior in an unfinished gallery was not considered strategic. Also, collecting and processing the desired quota of T&T samples in April and May would have taken more time than we had time within the original deadline of June 2014.

We opted for doing the stay-time study and the personal connections study because the data collection periods could be relatively short. The deadline was extended to August 2014 when it became clear that we should include a third method to capture additional overall data, and we scheduled the cued questionnaire data collection for the end of July.

Data from the three studies together give a relatively complete picture of visitors' use of the exhibits based on how long they spent and what they remember, and their answers to our open-ended questions give a clear view of the impact the exhibits had on them. ST visitors told us what they'd like to remember; CQ visitors told us what they perceived as the intentions of the exhibition, and what they learned; and PC participants fully articulated their ways of making connections with nature. Using grounded theory, these data revealed characteristics of visitors' experiences that will be useful for planning and evaluating informal learning and interpretation of natural science in a variety of settings.





SECTION 1. STAY-TIME STUDY

The purpose of the stay-time study and the different analyses was to see how long visitors spent in the gallery, which is an indicator of engagement. It also explored whether time spent correlated with any visitor demographic variables. As visitors completed their visits, they were also asked one open-ended question about their time in the gallery: "Overall, thinking about what you saw and learned in this gallery today, finish this sentence: 'I would like to remember...'" The exit question for the ST participants was meant to gather evidence for what new information and/or experiences were meaningful to them from the exhibits they encountered. Details of the methods are included in Appendix 1.

About the sample

There were 103 people in the stay-time study. (See Appendix 2 for spreadsheet of all ST data.) Participants were recruited randomly as they entered the Natural Sciences Gallery. Data collectors noted each subject's gender, group size and group type (adults only or adults with children), and the time of day he or she entered and exited the gallery. Visitors were asked if this was their first visit to the NSG, and if they had any special interest, knowledge, or training in natural sciences.

More subjects were in adult-only groups than in mixed-age family groups. There were more females than males, and most were first-time visitors to NSG: 69% were making their first visit and 31% were repeat visitors.

Data were collected on four days, with the largest number of visitors sampled on a Friday. The majority of visitors in the ST study entered the gallery before 6 p.m.

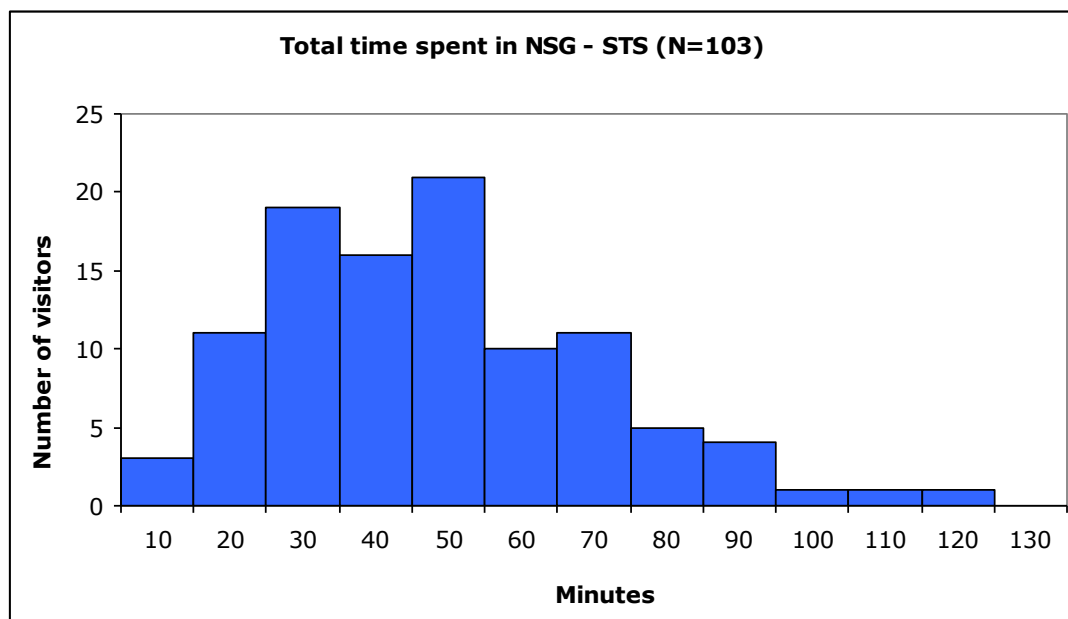
ST study visitor background	Percent (N=103)
Wednesday	31%
Thursday	21%
Friday	48%
Female	63%
Male	37%
Young adult (18-24)	11%
Adult (25-65)	68%
Senior (65+)	21%
Adult-only group	68%
Adults & children	32%
Entered gallery during day	68%
Entered gallery during evening	32%

ST study visitor background	Percent (N=103)
Making first visit to NSG	69%
Making return visit to NSG	31%
No special interest	63%
Special interest	36%
No data	1%

About one-third of the sample said “yes” to the question, “Do you have any special interest, knowledge, or training in natural sciences?” The types of answers included education, profession, hobbies, and nature activities. For a detailed breakdown of the types of special interest, see Section 4, page 53.

Time spent by ST study visitors

The average time spent in the gallery for the sample of 103 visitors was 44 minutes, which met the OMCA goal of exceeding 40 minutes (the average time in the old gallery was 10 minutes). Times ranged from a low of 10 minutes to a high of 1 hour 43 minutes.

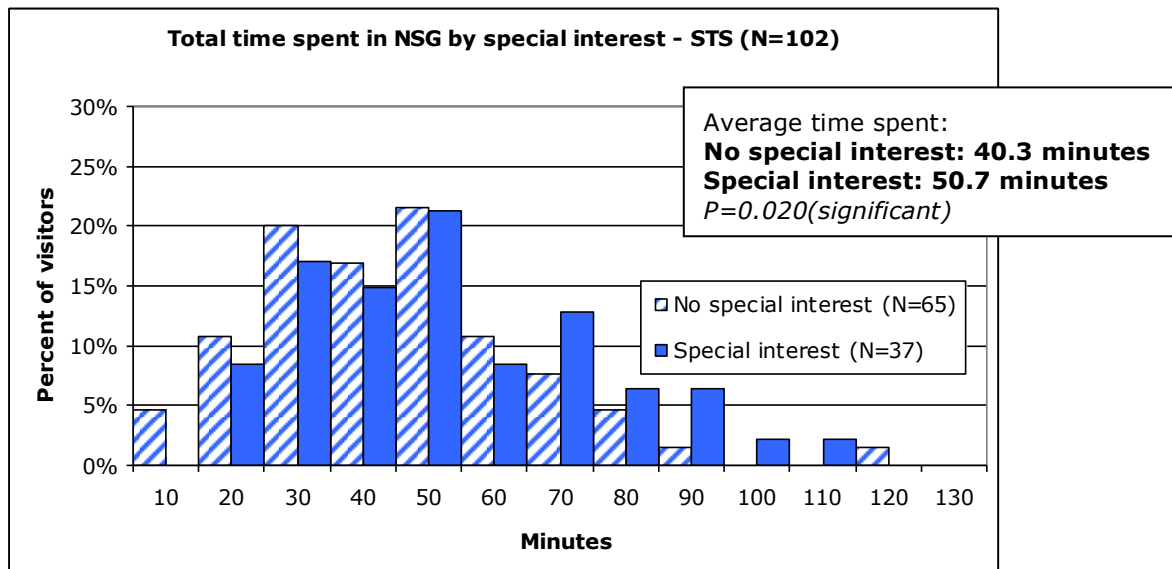


Visitors who spent more than 80 minutes were moving at a “sweep rate” of about 300 (square feet of gallery divided by average time), which is theoretically considered enough time to see about half of the exhibits (Serrell 1998).

Special interest seemed to influence time spent

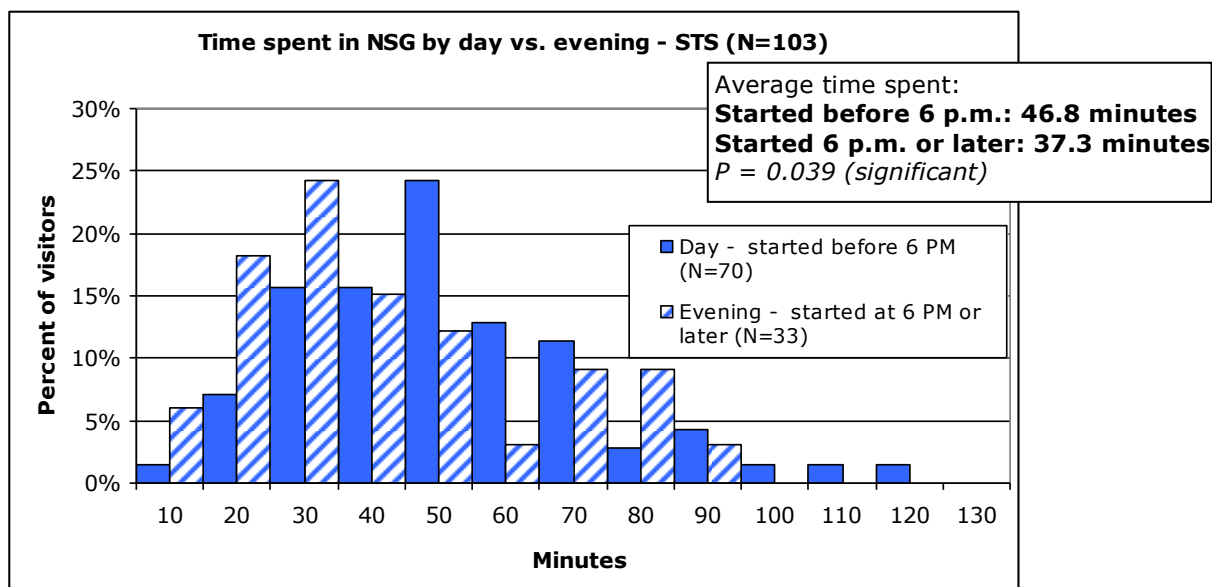
Visitors who said they had a special interest, knowledge, or training in natural science spent significantly *more* time than those with no special interests. Visitors who expressed a special interest spent approximately 10 minutes longer (on average) than those without any special interest (P=.020). This difference is unusual, and it’s not clear why it happened with these

data. Special interest did not have a significant effect in the CQ study, as has been the case in many other visitor studies conducted by Serrell & Associates.



Time of day seemed to influence time spent in the gallery

Visitors who came after 6 p.m. spent significantly *less* time than those who came in the daytime. Visitors who started their visits before 6 p.m. (day) spent approximately 10 minutes longer (on average) than those who started at 6 p.m. or later (evening). This difference was statistically significant ($P=.03913$) and probably occurred because the evening visitors had a limited time until the museum closed, whereas daytime visitors had an opportunity for a longer stay.



Several other variables did not affect average time

Average time spent did not differ by gender (M vs. F), group type (adults only vs. adults with kids), or visitation history (first-time vs. repeat visit).

ST <i>t</i> -tests for independent samples (equal variances)	N	Mean time (minutes)	P	
Adult-only groups	70	42.6	0.443	<i>not significant</i>
Adults & children	33	46.2		
Day visit (before 6 p.m.)	70	46.8	0.039	<i>significant</i>
Evening visit (6 p.m. or later)	33	37.3		
No special interest	65	40.3	0.020	<i>significant</i>
Special interest	37	50.7		
Females	65	44.4	0.683	<i>not significant</i>
Males	38	42.6		
Repeat visitors	32	46.1	0.467	<i>not significant</i>
First-time visitors	71	42.7		



Exit question for ST study and findings

Stay-time study subjects were asked one open-ended question after they had viewed the gallery:

“Overall, thinking about what you saw and learned in this gallery today, finish this sentence: ‘I would like to remember...’ ”

Data collectors transcribed visitors’ answers and entered them into the database along with the other information gathered. We used iPads with SurveyMonkey software to record the data. See Appendix 2 for all responses to this question.

Analysis of “remember” answers by topics

Two topics or themes were most commonly talked about:

- About one-third of the “remember” answers related to animals and natural settings, and
- Another one-third of the remarks were about the changes related to human impact.

Most of the other visitors said they wanted to remember specific exhibits in the galleries.

Animals and natural settings

In answers related to the animals and natural settings, people named specific animals, including albatross, snakes, birds, sea creature, pelicans, roots, moss and lichen, bears, redwoods, streams, trees, oaks, elk, goats. They referred to general habitats (desert, ocean), ecology, environment, nature, regions, and areas. For example:

The different areas of CA that I didn't know about and the animals I wasn't aware of that were in CA. (95 ST)

How vast nature is and all the material on these animals. (29 ST)

Impressive undersea wildlife I've never seen before. (98 ST)

That none of this stuff (animals, nature) is in the city. We were familiar with a lot of this stuff from nature, it seemed true to nature. (65 ST)

They also mentioned landscapes, but that may have been in response to the “Inspiration Points” landscape paintings on view in the special bays at the time of this study.

Changes related to human impact

Remarks related to the changes in nature due to human impact included extinction, road kill, plastics, “how our actions affect,” “how much has changed,” and “before humans.” For example:

How the things on display show how much damage humans have done to animals, like the car (road kill) or the albatross. (24 ST)

The beauty of nature before it's gone. (82 ST)

How bad plastic is for the environment and for the oceans especially. (70 ST)

The fact that there used to be so many creeks and streams in this area, there are none with fish here anymore. (90 ST)

A few people included both topics (nature and impact), such as:

Fascinating things. Lengths of the roots of the grass to survive the drought and in the desert. Staggered by the amount of plastic found in the ocean, horrified. (75 ST)

The interconnection between natural beauty and how we took from it, the exploitation of that beauty for human and artistic spiritual lessons. (33 ST)

The natural world is something we don't come in contact with on a daily basis so it's wonderful to see it represented. Also (like to remember) the ecology and the ocean. I've seen plastic floating in the ocean. (31 ST)

Many others briefly mentioned an exhibit they saw, with no impact or affect:

Seeing the tunnel (08 ST)

Mapping the oak trees (25 ST)

The art next to the stuffed animals (13 ST)

Analysis of "remember" answers by exhibit area

Another way to group visitors' responses to the "I would like to remember" prompt was by the exhibit areas they mentioned, i.e., the seven places in California featured in the NSG.

California was the most commonly mentioned place (rather than any of the seven real places). It was named 15 times, including two people who even echoed the introductory label's "Come explore a changing California."

How much California has changed in such a short time. (26 ST)

How mankind has changed CA over the years. I think that is the message here. (96 ST)

Oakland was named 10 times, plus East Bay, Berkeley, and "the city." People mentioned the oaks and redwoods, mapping the oaks, Sausal Creek, native plants, and the changes in Oakland over the years.

Most be [sic] impressed with the entrance with the Oakland tree sculpture. Draws you into this museum being in Oakland. (105 ST)

The local history and natural history here in Oakland and the East Bay. (20 ST)

The thing that had the most impact was the photo of the bark that was stripped from the mother of all redwood trees. I know they were cut down. But to do that and then it didn't survive. It was horrific to know. (71 ST)

All the oaks that used to be in Oakland. (77 ST)

Cordell Bank was mentioned by name 7 times, most commonly as "I didn't know...".

The Cordell bank, never heard of it before. (114 ST)

Plastics were mentioned six times. The video and undersea wildlife and the albatross were noted.

My most memorable is the video under the ocean. (100 ST)

The thing that had most impact was what the plastic does to the animals, what our laziness does to our environment. People have been selfish. (41 ST)

Mount Shasta was mentioned three times, all concerning the water story.

I was reading the Shasta water display about the drought. Was not aware that they had 150 year droughts. Was hoping that this would be over, but maybe not. (84 ST)

Sutter Buttes was recalled twice, with people expressing interest in it.

I want to see the Sutter Buttes area again. I don't know much about that region and I want to study that more. (37 ST)

That the Sutter Buttes were considered a mountain range and all the animals that were and still are in the mountains. (80 ST)

Coachella Valley area was mentioned by two people and the live animals there were surprising.

The live animals in the Coachella valley. It was unexpected to see live animals. (60 ST)



Yosemite was mentioned only once.

Yosemite, because it reminded me how much it means to me. (55 ST)

The Tehachapis was not mentioned at all, nor were the main features in that area (Joshua tree, condors, chaparral, termites, sage) that we will hear mentioned in the PCs.

Seven special places was almost mentioned by one person who obviously had seen the old gallery:

I would like to remember all of it. At first it was difficult for me for the change, but I enjoyed the map and seven different sections. I enjoy it overall. A great improvement. (116 ST)

The quote above was the only mention among all three studies where anyone actually said "seven sections." There were people who referred more generally to all the regions or areas shown, such as:

All the regions of CA. (46 ST)

The different areas of CA that I didn't know about and the animals I wasn't aware of that were in CA. (95 ST)

The different ecologies that were highlighted here. (97 ST)

Microscopes, dioramas, dimensional maps, artwork, bones and samples, or general references to exhibits were mentioned by about 10 people. Five visitors mentioned landscapes and "Inspiration Points." Three said the exhibits were "good for kids."

Analysis of "remember" answers by intended actions

Another small grouping of people's open-ended "I would like to remember..." answers was what people wanted to remember *to do*. In about 10 of the responses, visitors hinted at some action. For example, four people wanted to do something else out in nature:

How varied the environment is in the East Bay and to pay more attention to it when I'm outside. (28 ST)

Came in specifically to look at landscape exhibit. I will remember that the most. Other parts we looked at in a cursory way. What I take away is all the different ways that I [we] would like to interact with nature in California. (81 ST)

I would like to remember that I can visit a lot of the parks in the area. (86 ST)

There is a redwood stump table. There is a little video about fort making. We walk in that park with my son and we saw that. We go out there, but interesting to watch others do it and will try to remember to bring supplies and do this himself. (101 ST)

Other four said they wanted to remember to come back to the NSG:

To come back; great activities for kids. (6 ST)

To come back here; hard to find places that are both kid and adult friendly. (15 ST)

To come back — I want to see the Sutter Buttes area again. I don't know much about that region and I want to study that more. (37 ST)



To come back again. I like the Cordell bank I never knew about that. (58 ST)

Conservation biology and natural science museum exhibits often have the goal to make visitors more conscious of their negative impact on the environment and to change people's behaviors, i.e., to reduce their impact and to take positive action. This was indeed a desired goal of this exhibit. In the summative evaluation of the NSG, we did not directly ask people if they intended to do anything differently as a result of seeing these exhibits, yet there was a hint of evidence in the "remember" answers that some ST visitors were interested in making some effort.

The creeks, the Sausal one especially, it made me want to volunteer to help restore it. (66 ST)

I felt sad because of what is happening to nature and I would like to remember to put more effort into protecting living organisms. (93 ST)

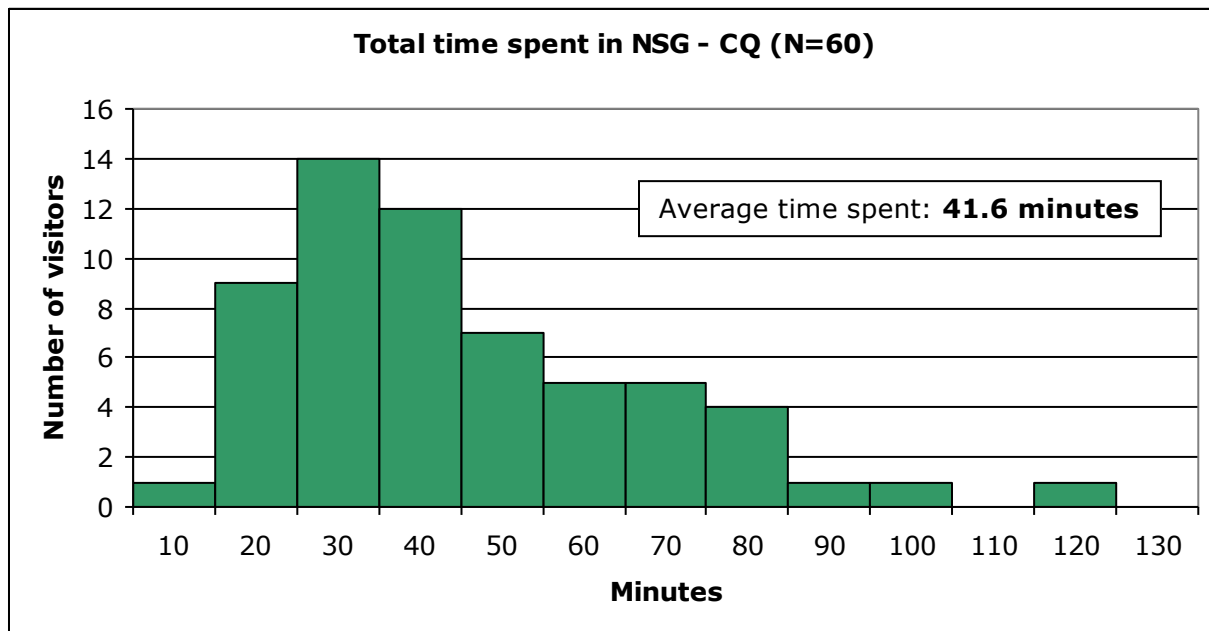
SECTION 2. THE CUED QUESTIONNAIRE STUDY

The cued questionnaire (CQ) was a one-page open-ended questionnaire that 60 visitors responded to with written answers using their own words. The point of the cued questionnaire and the different analyses is to see the degree to which visitors got the main ideas and found new information and/or experiences that were meaningful to them from the exhibits they encountered.

People were recruited as they entered the NSG with the request to fill out the form after they finished their visit. They were not shown the form beforehand. The recruiters told people to stay as long as they wanted and gestured them toward the introductory area (away from the "Inspiration Points" bays) to start their tour. Details of the methods are included in Appendix 1.

Time spent by CQ visitors

The average time spent in the gallery by the sample of 60 visitors was 42 minutes. Times ranged from a low of 9 minutes to a high of 1 hour 55 minutes.



This histogram shows the distribution of the times spent by CQ subjects in the NSG. It is very similar in shape to the time spent by the larger sample of ST visitors.

Two significant differences were noted among the subgroups of CQ subjects: Visitors in the evening spent less time than daytime visitors, which is the same finding from the ST data. Visitors with children spent more time on average than adults-only groups. Maybe this had something to do with the time of day or the day of the week (which is not included in this analysis).

CQ <i>t</i> -tests for independent samples (equal variances)	N	Mean time (minutes)	P	
Adult-only groups	37	36.2	0.008	significant
Adults & children	22	51.9		
Day visit (before 6 p.m.)	50	45.6	0.001	significant
Evening visit (6 p.m. or later)	10	21.2		
No special interest	41	41.7	0.929	not significant
Special interest	19	41.2		
Females	34	39.4	0.399	not significant
Males	26	44.4		
Repeat visitors	15	43	0.633	not significant
First-time visitors	44	39.9		

Among the other demographics we found no significant differences in time spent (e.g., gender, repeat vs. first-time visitors, and visitors with a special interest vs. no special interest.) For more comparison of the demographics with the other studies, see Section 5, starting on page 55.

The next part of this section will describe the findings from each of the questions asked on the CQ. (For all CQ responses, see Appendix 3.) We will also review the key words and trends that emerged and compare them to the messages intended by the exhibition team. In the second part of this section we consider visitors' overall answers to the questions and compare them to the messages in the exhibition's introductory text: Did visitors get what the exhibit said it was about?

CQ questions

The questions on the CQ were:

1. Overall, what would you say is the main purpose of the displays in this gallery?
2. What is one new idea you are taking away with you?
3. Anything else?

These seemingly simple open-ended questions yielded rich and detailed answers. Visitors were thoughtful and spent from 2 to 5 minutes writing their answers.

Analysis by key words, emergent themes, and NSG goals

Question 1: Purpose

The first CQ question about the purpose was followed by two prompts or stems as the first part of their answer:

“To show...”

“To make people...”

We know from past studies that visitors tend to respond to the prompt “To show...” by describing the content of an exhibition (what the museum presented), and that they tend to respond to the second prompt “To make people...” by describing the museums’ intended impact with that content. The question and prompts encourage visitors to think broadly. The participants in this study followed that trend.

A concrete and simple analysis of the CQ answers to both of these prompts is to look for commonly used key words or clusters of those words.

To show...

Below are the most commonly used key words and the frequency of their use:

- “California” was named 40 times
- 29 uses one or more of these words: wildlife, ecology, nature, life, landscape, natural history, environment, ecosystem, variety
- 6 people mentioned that it showed things that people may not know about or be aware of

The next most frequent clusters of key words associated with “To show” were:

- 15 uses one or more of these words: change, changing, impact, danger, fragile, clash, extinct, good and bad
- 5 mentions of responsibility, stewards, conservation efforts, local issues
- other mentions of animals, Oakland, CA regions

Twenty-one of the 60 respondents used words associated with both wildlife and change. For example:

To show the native wildlife and habitats people are generally unaware of including local community issues and conservation efforts. (22 CQ)

To show life in California: how it was, how it’s changing both good and bad. (29 CQ)

To show the California natural landscape, how it has changed, and things that people may not be aware of. (33 CQ)

To make people...

In response to the second prompt, “To make people...”, the number of visitors who used the following key words at the beginning of their answers included

- 20 who said aware of nature, issues, adverse effects, human impact, change
- 9 who said appreciate nature, issues, etc.
- 9 who said learn, more knowledgeable, understand, educated
- 9 people who said think

- Other words used: care, value, reflect, consider, respect, take better care, take action, feel, sensitive, curious

Twenty-seven of 60 gave "To make people" answers that again held the dual thoughts of nature and change. For example:

To make people aware of the Californian landscape and understand the issues at play in our natural surroundings. (55 CQ)

To make people appreciate it, knowing its history, value to our environment and possible ways to preserve it. (53 CQ)

Question 2: New idea

The next question on the CQ was, "What is one new idea you are taking away with you?" There were two prompts for this question. The first prompt was "I didn't know, or I never realized..." The second prompt was "It reminded me..." The question and prompts encouraged visitors to think about some of the details of their experience with the exhibits.

Only four of the 60 people did not answer this question; 56 of 60 would be considered a high response rate for a smaller exhibition, but in the NSG's 25,000 square feet, most people found something to say.

I didn't know, I never realized...

Some visitors' answers were so specific that we could pinpoint where in the NSG they probably got the idea. The specific exhibits, or places named, and the number of mentions included

- Grizzly bears, mentioned 6 times
- Sutter Buttes, mentioned 6 times
- Plastics in the environment and/or albatross, mentioned 6 times
- Oakland, Mt. Shasta, Cordell Bank, mentioned 4 times each
- Bees, East Bay Parks, condor, Coachella, elephant seal, lava flow tunnel, black bear, albatross flight, "one pair of jeans," mentioned once each

For example:

I didn't know that the California Grizzly Bear was extinct. (03 CQ)

I didn't know so much of Sutter Buttes is privately owned. (50 CQ)

I never realized the role of Mt. Shasta in our water system. (25 CQ)



I never realized there is so much plastic that is harming the environment that can be used as a renewable resource. (01 CQ)

Others topics were more general or could be found in more than one area.

- Human impact and diversity were mentioned 4 times each
- Creeks were mentioned 3 times
- Drought, fire, fishes were mentioned 2 times each

For example:

How much we make an impact in California. We meaning humans. (41 CQ)

The depth of diversity that exists in California's wildlife. (43 CQ)

It reminded me...

The next prompt that was part of the “one new idea” question is, “It reminded me....” This prompt was originally developed for summative evaluations by Serrell & Associates to be inclusive of visitors who were already very familiar with the exhibition’s topic—especially in smaller exhibitions. It has served that purpose, but it also has prompted many people to be more affective and reflective in their answers than for the other questions so far. The participants in this study followed that trend.

Visitors were reminded of places they’d been and recalled things they’d done; they spoke strongly about some issues; they talked about actions they wanted to take. Many of the things they said were similar to what the NSG exhibit developers were hoping to hear.

Places

Visitors recalled memories of things they’d done and places they’d been.

It reminded me about when I first saw the ocean and as a child explored the woods. (06 CQ)

It reminded me a lot about when I was growing up, some of the things like the specific type of butterflies and bees I really don't see a lot anymore. (20 CQ)

Superlatives

In the next examples of “reminded me” responses, you will hear some stronger feelings and thoughts that emerged in the “reminded” CQ feedback, some that were about human impact, some valuing nature’s beauty:

It reminded me of how there are too many people in California. (34 CQ)

It reminded me that there were many animals that lived before us and that we will never see them live. No more CA grizzlies ??! (62 CQ)

It reminded me that we should be more observative [sic] of wildlife and rethink the way we are treating the Earth! (40 CQ)

It reminded me of how many awesome birds and reptiles live in California. (67a CQ)

It reminded me of the preciousness of our natural resources. (15 CQ)

Of actions—To do, to be...

People's answers to the "reminded me" prompt also contained many references to things they wanted to do. Many of them had a conservation theme.

It reminded me to be more conscious in conserving and using materials that would leave less of a footprint and impact on the natural habitat. (22 CQ)

We need to be good stewards of our planet and the innocent animals who inhabit it. (37 CQ)

It reminded me to be more proactive in conservation efforts. (67b CQ)

It reminded me of the need to get out and start exploring more of what our state has to offer. (04 CQ)

A note about the prompts used in the above CQ questions: All the prompts were derived from the natural way people answer the typical summative evaluation questions, "What was the exhibition about?" and "What did you learn?" These "stems" facilitate visitors' authentic thinking and answering.

Anything else

The last question on the CQ was, "Anything else?" (it did not include prompts or stems), which usually becomes the repository for people's compliments or complaints, and not everyone usually makes a comment. Participants in this study followed this trend. Twenty of 60 people did not give an answer; 30 of 60 gave a positive rave and about half of those named something specific. Most commonly mentioned were interactives, dioramas, and Cordell Bank's underwater experience. The bean bag chairs were mentioned as being "good for kids" and not good for adults or seniors who wanted more comfortable chairs. A few people mentioned that they wished they had had more time to look at the exhibits.



Echoes of staff goals

Four members of the NSG exhibition team filled out the same CQ. The answers given above by visitors resonated positively with the words used by the staff members who defined the dual purpose of the NSG as “To show” *diversity of habitats and threats to them*; and “To make people” *understand, care, consider, and take action*.

In doing the analysis of the visitors’ answers on the CQ, we saw that the trends were generally similar to the messages intended by the exhibition team as evidenced by their answers to the same CQ question. For example:

Staff member said: The purpose of the NSG is **to show** the tremendous diversity of habitats and life forms in California and the ways in which humans and nature interact and impact each other.

Visitor said: *The purpose of the NSG is to show the diversity of nature throughout California and how nature and modern civilization can clash. (24 CQ)*

Staff member said: The purpose of the NSG is **to make people** care more about nature and the environment in which they live, and understand that nature is all around them.

Visitor said: *The purpose of the NSG is to make people like nature, and feel it is all around them, and take better care of nature. (46 CQ)*

Staff member said: The purpose of the NSG is **to remind people** to be more conscious of their ecological footprint.

Visitor said: *The purpose of the NSG is to remind people to be mindful and to leave a smaller footprint. (60 CQ)*

Analysis by overall CQ responses, exhibit goals, and NSG affordances

Now we will turn our attention to what the Natural Science Gallery said it was about, by looking at the introductory text and the exhibit affordances that support those goals. The introductory text says:

Changing California

It’s one of the world’s most biologically diverse places—and one of the most threatened. Profoundly changed by humans in less than 200 years, California faces even more change as the planet warms.

We’ve organized this gallery around seven real places. Each reflects a unique part of California’s natural heritage, the pressures it faces, and the inspiring ways local communities are caring for it.

Come explore a changing California.

The main messages

We parsed six different main messages from the introductory text, which were:

- (1) California is/has changed.
- (2) It's one of the world's most biologically diverse places.
- (3) It's one of the most threatened. Profoundly changed by humans.
- (4) California faces even more change as the planet warms.
- (5) Seven real places are unique parts of California's natural heritage.
- (6) The inspiring ways local communities are caring for it.

We've include also a seventh message: "You can help" from the big idea (which wasn't mentioned in the intro label). It is similar to the main message number 6 but is more personal. (See page 56 for a discussion of the big idea.)

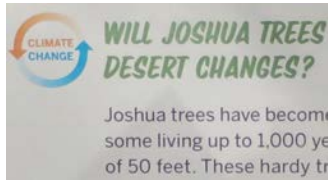
The 60 CQ data sheets were analyzed for any evidence that visitors talked about these messages in their answers to any of the questions. The totals on the table below equal more than 100% because some people mentioned more than one message.

Main messages (from intro label text)	Number of visitors mentioning at least once	Percent
Changing California (any mention other than human impact)	7	12%
California is one of the world's most biologically diverse places	18	30%
California under threat - Profoundly changed by humans	32	53%
CA faces more change with global warming	1	2%
Places in CA—unique part of heritage, face pressure (no one mentioned "Seven real places")	17	30%
Local communities are caring for CA natural landscape	2	3%
You can help	28	48%

Conclusions reached from the above chart are:

- There is no doubt that this gallery is about California.
- Seeing human impacts was often memorable. The "threat" theme was the one most commonly mentioned. Slightly more than half of the visitors mentioned something about negative changes.
- The "diversity" theme was counted if they used any of the words associated with it, such as variety, array, many kinds, etc., and it was mentioned by almost one-third of the CQ sample.

- The specific messages of climate change did not have much impact even though they are called out with a double-arrow icon. Climate change/global warming was only mentioned by one person.



- Although the “SEVEN REAL PLACES” are referred to several times in the welcome area, and each place is named with a kiosk and topo map, nobody used the phrase. None of the staff CQ responses mentioned the seven special places theme, either.



A “places” message was counted, however, if a person mentioned any one of the places—Oakland, Sutter Buttes, Mt. Shasta, Yosemite, the Tehachapis, Coachella, or Cordell Bank—and 30% did. The most any visitor mentioned was two places. Oakland was the place mentioned most often. No one mentioned the Tehachapis.

Places named	Number of mentions
Oakland	11
Sutter Buttes	5
Cordell Bank	4
Mt. Shasta	3
Coachella	1

- The “You can help” theme was prominent and expressed in a variety of ways, and it appeared in all of the CQ prompts (purpose, new idea, reminded me). Almost half of the visitors said what behaviors they might do, or what people should be aware of, or the importance of conservation. But the “you can help” was not often tied to an affordance in the exhibition, e.g., the places where local communities were shown helping the environment. This suggests that visitors were basing their “you can help” ideas on recall or on the prior knowledge they brought with them.

High, medium, and low rankings for CQs

Continuing with the goal-related analysis, the 60 CQ samples were rated overall for the number of different main messages they contained. Out of the seven possible main messages, the most any one visitor mentioned was three. The next table shows the ratings and scores for high, medium, and low.

Overall messages rating	Count	Percent	Criteria
High	12	20%	<i>Mentioned at least 3 main messages</i>
Medium	23	38%	<i>Mentioned at least 2 main messages</i>
Low	25	42%	<i>Mentioned fewer than 2 main messages</i>
All CQ visitors	60	100%	

The fewest visitors (20%) were rated high. Given that there were seven main messages, it is unlikely that any people would mention them all. Medium and low accounted for 80% of the sample. On the other hand, given the seven messages, most people did show evidence of getting at least one.

One visitor (22 CQ) had the highest score of 4; this visitor's comments consisted of three main messages and a "you can help" comment and was ranked high. This is how this person's answers aligned with the some of the main messages:

California is one of the world's most biologically diverse places
[I didn't know/realize] the diversity of wildlife I've never seen or encountered first hand on nature walks or hikes. (22 CQ)

California under threat - Profoundly changed by humans
[The purpose of the displays is to make people] think about the natural environment, their possible excessive use and how it can have an adverse effect on wildlife. (22 CQ)

Local communities are caring for CA natural landscape
[The purpose of the displays is to] expose the general population and provide education in regards to the native wildlife and habitats people are generally unaware of including local community issues and conservation efforts. (22 CQ)

You can help
[It reminded me] to be more conscious in conserving and using materials that would leave less of a footprint and impact on the natural habitat. (22 CQ)

Another visitor (28 CQ) was ranked low for having just one main message:

California is one of the world's most biologically diverse places
[I didn't know/realize] There were so many species of wildlife. (28 CQ)

No one gave any answers that were wrong. Even the one person (51 CQ) with no main messages had a good experience that was personally meaningful. She just didn't say anything that aligned with the NSG's goals.

Visitor 51 CQ's answers were:

[To show] *Awesome marine life, I would have liked to spend the entire day.* [To make people] *Peaceful.* [Didn't know/realize] *the size of the elephant seal.* [Reminded me] *of the aquarium in Monterey.*

Clearly this person made it to the Cordell Bank area and liked it.



See Appendix 4 for a breakdown of the scores, ratings, and themes in this analysis.

The point of the cued questionnaire and the different analyses was to see the degree to which visitors got the main ideas and found new information and/or experiences that were meaningful to them from the exhibits they encountered. We believe that there is abundant evidence that visitors have engaged meaningfully with the exhibits in the NSG.

SECTION 3. PERSONAL CONNECTIONS STUDY

The tight evaluation schedule made it logistically impractical to include all parts of the Natural Sciences Gallery, so this study concentrated on just three areas of the NSG: Oakland, Yosemite-Techachapi-Coachella, and Cordell Bank. Participants did not see the introductory area, the changing exhibits area with the landscape paintings, the Sutter Buttes or Mt. Shasta areas, or the Futures Lounge. Nevertheless, these study areas accounted for about 80% of the total NSG square footage.

About the sample and methods

Participants for the personal connections study (PC) were recruited ahead of time by the OMCA. They came to the museum at an appointed time to meet with an evaluator. Each person signed release forms, and received a check for \$50 for his or her participation, which lasted about 45 minutes.

Most of the participants were from Oakland or a nearby community. Some of them had been to the OMCA before; for most it was their first visit to the new NSG. The majority did not express a special interest in natural sciences.

Participants were loaned a point-and-shoot digital camera (with the flash turned off), and they were escorted to one of three specific areas of the NSG listed above. There they were instructed to take six to nine photos of exhibits where they "felt a connection" with nature. After about 20 minutes, they sat down with the evaluator and talked about their photos. Interviews were recorded and transcribed. See Appendix 1 for details of the recruitment, instructions, software used, and other protocols of the PC study.

Study questions

We investigated two questions with participants in the personal connections study: Did visitors make personal connections with nature? and, Did they see any exhibits that dealt with human impacts on nature? Overall, the answer to both questions was strongly yes.

For each photo that a person took, interviewers asked, "What was it about this that helped or made you feel a personal connection with nature?" At the interview's close, visitors were asked if they'd seen any exhibits about human impacts, even though many people had already mentioned something about this in their "connections" answers.

See Appendix 5 for a spreadsheet of the demographic information of the 35 subjects, along with which exhibits they photographed.

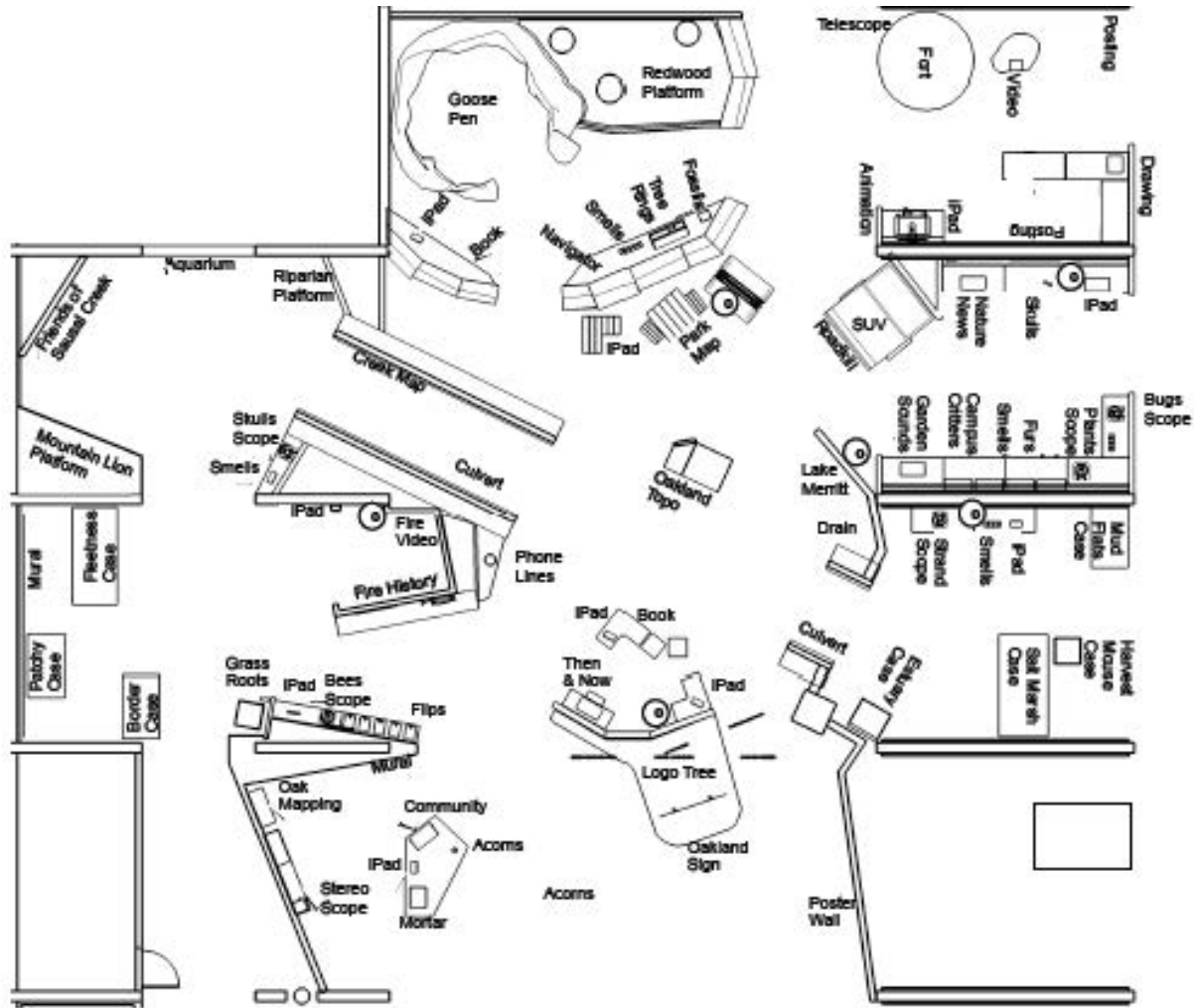
We looked for visitors' personal connections and meaning-making in three areas in the NSG, which contained different topics and densities of exhibits. The areas and the number of visitors who were asked to go there were:

OAK (N=11) The Oakland Zone, the first area beyond the CA floor topo map, up to the doorway leading to Sutter Buttes, including three bays (but not the first, special exhibits bay)

YTC (N=15) The areas for Yosemite, the Tehachapis, and Coachella Valley, including five dioramas

COR (N=9) The Cordell Bank gallery, with the theater

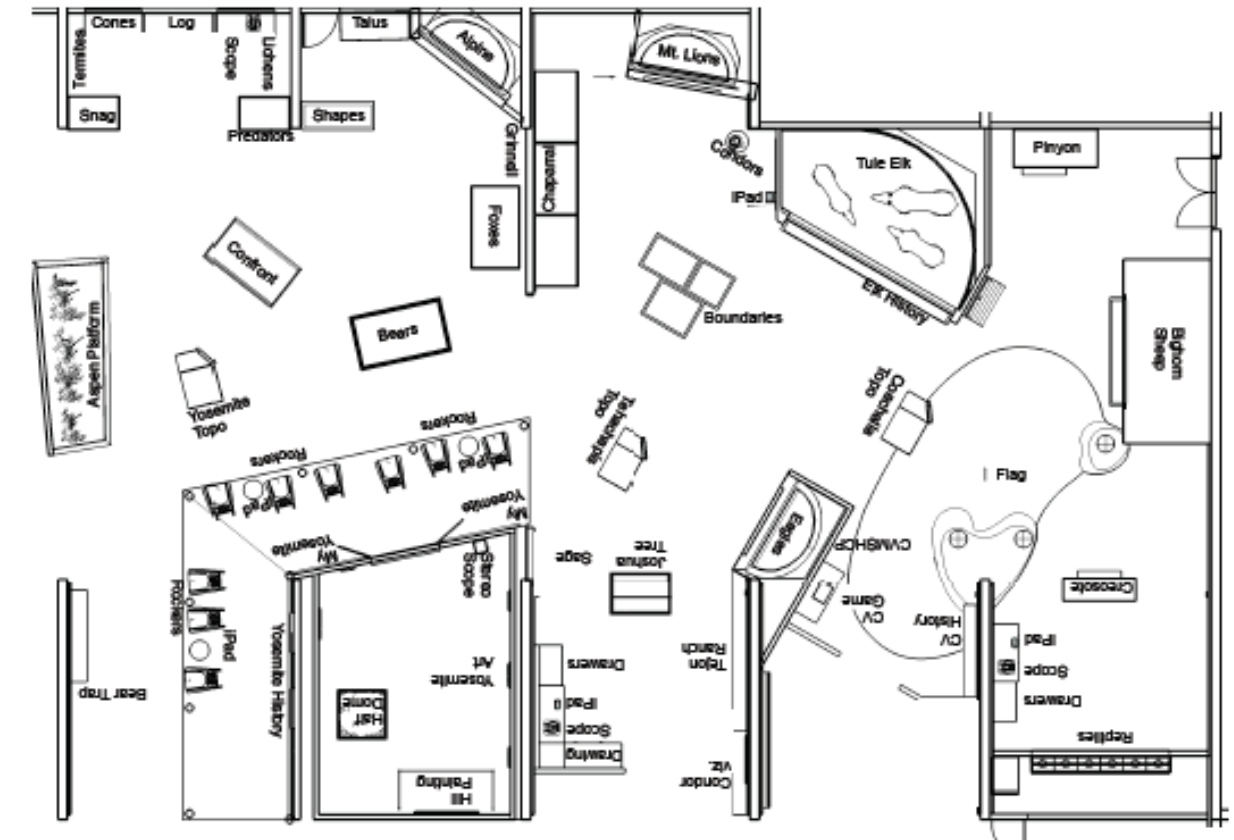
Oakland



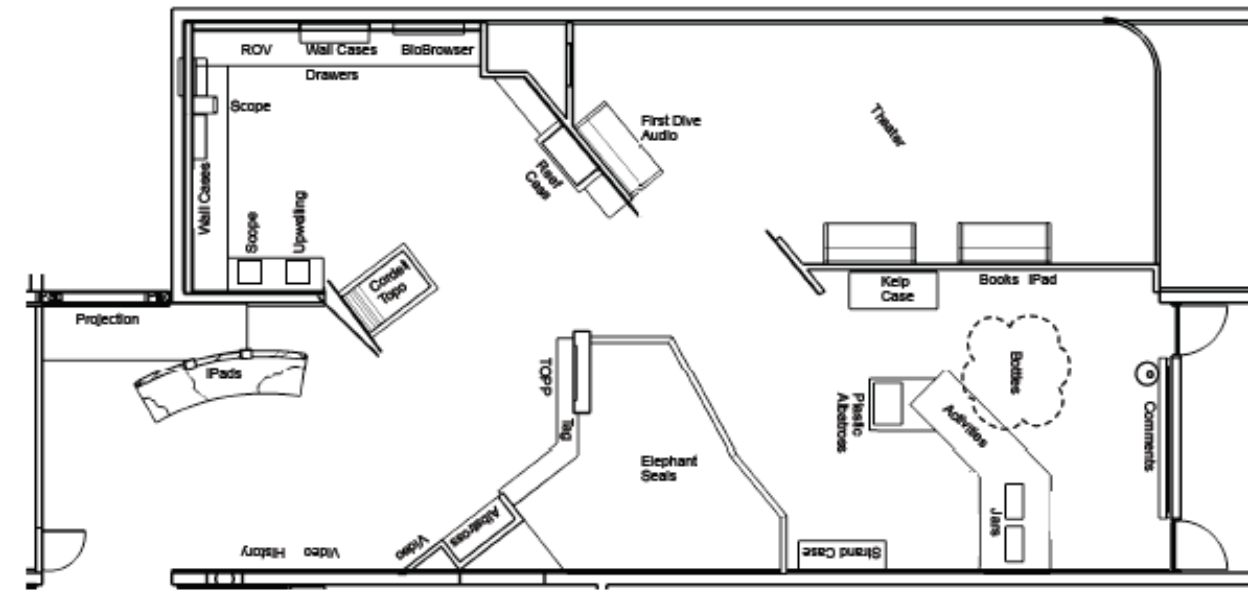
Yosemite

The Tehachapis

Coachella Valley



Cordell Bank



How people made personal connections with nature

In the transcripts of what visitors said about their photographs, different ways of making connections with nature emerged from the data. Study participants seem to have made personal connections in three main ways:

RECALL of memories, SENSORY experiences, and by gaining NEW PERSPECTIVES.

Definitions of these ways of connecting are followed with examples as spoken by visitors. They used the three ways with some interesting differences in frequency in the gallery areas, which will be discussed starting on page 35.

Recall

Visitors said, "It reminded me...", and they made connections through familiarity with and memories of prior knowledge, interest, and activities that were triggered by seeing exhibits. They were reminded of places they'd visited, activities they'd participated in, animals they'd seen before, topics they were already interested in, or emotional connections they brought with them. Family, job, and leisure interests were the basis for many connections. Personal background and recall connections were related mostly to "internal" responses, i.e., it was more about them than the exhibits. Recall is what visitors brought with them to the exhibits.

Sensory

Visitors commented about the physical properties of exhibit features and their preferences for types of exhibits. Subjects reacted to what they saw, read, heard, and smelled—the size and scale, beauty, color, movement, sounds, realness, media, and other design features. They sensed the "vastness" of nature. Things were "cute," "humongous," "peaceful," "enjoyable," "cool," "clever," "realistic." They were surprised to see live animals. They liked seeing things close up or being able to zoom in with the microscopes. They enjoyed the diversity of specimens in the drawers. These connections seem to be related more to "external" responses, i.e., it was about the exhibits. Sensory was about what they saw or did, which often led to new perspectives, but not always.

New perspectives

Connections were made through provocations involving the context of the exhibit environment through feelings, learning, and discoveries during their interactions with the exhibits. They saw things they'd never seen before, or thought about them in a new way by seeing them up close. Visitors said, "I didn't realize..." and "It made me think...", leading to new knowledge, altered feelings, questions, and sometimes intentions to do something as a result of their exhibit experiences (e.g., place to visit, animal to look for, activity to participate in). Things were "interesting," "inspiring," and visitors were "transported" and felt more respect and empathy. The idea of "change" came through in these comments. New perspectives were synthesized as visitors recalled, sensed, engaged and used their immediate experiences with the exhibits.

The following quotes are examples of the three ways of connecting RECALL, SENSORY, NEW PERSPECTIVE in the three areas OAK, YTC, and COR.

Recall in OAK

Recall responses related to where people lived and grew up in California, often specifically in the Oakland area.

I love the reminder of all the animals that live right here. I love being able to look at these and see what I have seen on a certain night, or often during the day. (14 OAK)

I was raised on a farm in central California and jackrabbits were all over my Dad's vineyards and orchards. It was a thrill to see them run—the dogs would chase them. Sometimes they caught them. (22 OAK).

I grew up driving by back and forth with this view of the old Bay Bridge. Some day that bridge is going to be gone. And then those cranes, I mean there are always there, like the guards of the Bay, or something. No matter which way you go, they're there. (81 OAK)

Recall in YTC

Recall responses included trips to particular parks or landscapes (e.g., desert) from childhood and as an adult; of activities such as camping or hiking; or of personal experiences unrelated to nature.

I go running in the hills, and something like this reminds me of the trails, the plants; reminds me of the stuff I run past and is familiar. (12 YTC)

I had done a camping trip, I forget the name of the area but it was also in the desert so this reminded me of that moment and the intense dryness and intense heat. (50 YTC)

So this one makes me think of camping as a kid... and throwing pine cones at each other. I think it's kind of universal to everybody that's been camping, a good anchor to memories. (43 YTC)

Recall in COR

Recall connections in COR included resident or family history in the general region and personal interest in or experiences with featured animals.

One of my favorite foods in the world is tuna and when I enjoy it I think about where it came from. I saw it and I was like, "tuna, cool." I don't think we're like soul sisters or anything, but I think it's a pretty awesome animal and I appreciate its existence. (101 COR)

Elephant Seal – my experience as a teenager in San Francisco, going on a field trip to Año Nuevo and witnessing the birthing of the pups there. My connection to this image really was a childhood memory and I'm grateful that that colony has continued to be successful. (47 COR)

I think that the person in this picture, the whaler, his home was in Oakland. I think the fact that he was from Oakland made it a little personal because I've lived in Oakland most of my life. And the fact that he's a whaler. My younger sister is a lot into sea life, so it made me think of her. (34 COR)

Sensory in OAK

Visitors talked about the feelings they had when viewing the exhibits.

What really struck me was that landscape photo. When you're see those big hills, those valleys, especially on a gorgeous day—that's the feeling I get when I'm actually in the actual, if you get a view like that. It's so vast, you feel like there's open country. (25 OAK)

And that was something I felt about all the taxidermied animals. While it was interesting to look at them, it was kind of creepy. Like it didn't feel living, moving, breathing, smelling. Like all of those sensory qualities I think of when I think of nature. (73 OAK)

I do love redwood trees and being able to see under the skin is fantastic. Something about the physicality of that really close up view where you can get right into the rings and see the edge, see the bark, where the tree ends. It seemed really tactile even though I wasn't touching it. (44 OAK)

Sensory in YTC

Visitors described getting absorbed in details of the exhibits, and seeing things they normally wouldn't be able to.

I like how it's a very close up and it was the footprints in the snow that got me—there's a story there. You're just waiting for something to happen. I was totally sympathizing for the pica, which I don't even think was in the picture. They were very small footprints. (88 YTC)

This is the one where the termites are moving around, and they're completely doing their own thing. They're also really disgusting and I really think it's cool. It's like playing a game because you're trying to find them and they're hiding. (116 YTC)

So the speaker, the audio is fantastic. It felt like I was out hiking. It's really for the environments of the exhibits that I've been to where the sound effects really tied it in. It's like the only thing that's missing is the smell. (43 YTC)

Sensory in COR

Visitors mentioned exhibit media, ways of displaying, or qualities of the featured animals.

I love being in that atmosphere watching the animal life and these amazing plants, they're amazing how big they are. The surround sound is awesome, what you're looking at is really cool. (101 COR)

I liked this a lot because I think it's done to size. I haven't really seen elephant seals up close, but when you stand next to it, it reinforces this sense of wonder: oh these animals really are humongous. You can imagine yourself standing next to an elephant seal, so it sort of triggers that sense of wow. (32 COR)

I felt a personal connection to nature here because I could actually see the litter that had been in the bird's stomach and probably caused him to die. When you're walking outside you often see people's trash and then you see the birds. You don't necessarily connect that they would be eating the trash. (51 COR)

New perspectives in OAK

Visitors mentioned information, learning, integrating ideas, synthesizing, and taking action.

I never would have imagined a creek running through such an urban part of Oakland. And I saw information about it in a lot of different exhibits. I liked that it highlighted the different community actions that were being done. I feel I am able to connect with nature in Oakland—to participate with clean ups, shore clean ups and stuff like that. (73 OAK)

First of all I didn't notice there was a bird on it. I was like, why are there all those seeds? It was really tall. So I thought it was interesting that one animal could be stashing away that many seeds. And then other animals eat off of it, too. (102 OAK)

So this piece called Land of Oaks kind of pretty much sums up what Oakland is, which is named after all these Oak trees. So it's very interesting for me to see the whole history, and the whole transformation of what became of Oakland. It's sad that we don't see that many Oak trees as before. (09 OAK)

New perspectives in YTC

Respondents had realizations about changing landscapes, diversity, the chance to see things up close, and, occasionally, actions they wanted to take.

I feel like I typically have an aversion to insects. But when I see something like this where I know the insect is interacting with something; I know that it's serving a purpose, a mutually beneficial relationship, it kind of makes me think about the perspective of the insect instead of feeling an aversion... (11 YTC)

The exhibit itself gave me an opportunity to get a little bit of learning about what kinds of birds I see when I'm outside. And it's a vantage point I wouldn't have if I was actually in nature. They're so beautiful, the diversity of birds. I'm going to get the Sibley Field Guide for my next hike. (23 YTC)

So this one goes really well with the putting green and the impacts of all of these golf courses in California. And I never realized that Palm Springs has the largest concentration of golf courses, which is just crazy because it's so dry there and it's just such a waste of resources. (39 YTC)

New perspectives in COR

COR respondents were especially likely to highlight exhibits that made them want to do something in the future or that evoked an emotional response (especially empathy, sadness, or guilt).

This is hugely about humans' impact on nature, and so I felt a connection in that sense. I felt bad for the bird, pity, I felt some guilt and shame on behalf of humanity. Even the way that the bird is laid out it almost looks like a crime scene. So I felt my impact on the world. (94 COR)



I had to read the informational placard to understand the difference between raking a beach and beach wrack. And then I understood that the natural items that collect on a beach, like algae and seashells, help the birds gather the information they need to be living things on that beach. So the personal connection was knowledge and maybe empathy. (87 COR)

I found the upwelling really interesting because I understand a little bit about tides and stuff. But I really didn't know how the movement of the water draws nutrients and foods up and you get a feeding frenzy. It did really make me think, it's like the restaurant opening. It's like all the marine life knows the tides. (01 COR)

These ways of making connections and finding meaning do not have hard boundaries; there are overlaps in the categories, and the ways were not often used exclusively for any one visitor or type of exhibit. Visitors' discussions of their photographs often moved fluidly from recall to sensory to new perspectives and back.

Initially we had been struck by the prevalence of comments that involved recall for the OAK and YTC sections. But after we did a more complete analysis, we saw that all three ways were used separately and also in connection with each other in visitors' comments about their photos, and that there were some interesting differences in the use of the ways in all three sections.

Patterns in the ways of making connections in the photo statements

Although the average number of photos taken by each person was six, a different number of photo statements were made for each gallery area. Totals varied with number of elements in the gallery, the number of participants, and how much they talked.

Gallery area	Approx. # of elements in the gallery area	# of participants (each took about 6 photos)	Total # of photo statements for each gallery
OAK	49	11	83
YTC	47	15	96
COR	29	9	55

Visitors made a total of 234 photo statements. Our analysis was performed by coding each person's photo statement for the ways of making connections that had emerged from the data. Each photo statement was assigned to one of seven categories based on how they connected with nature. Codes were for assigned with seven possible codes/combinations:

- Recall only**
- Sensory only**
- New perspectives only**
- Recall + sensory**
- Recall + new perspectives**
- Sensory + new perspectives**
- Recall + sensory + new perspectives**

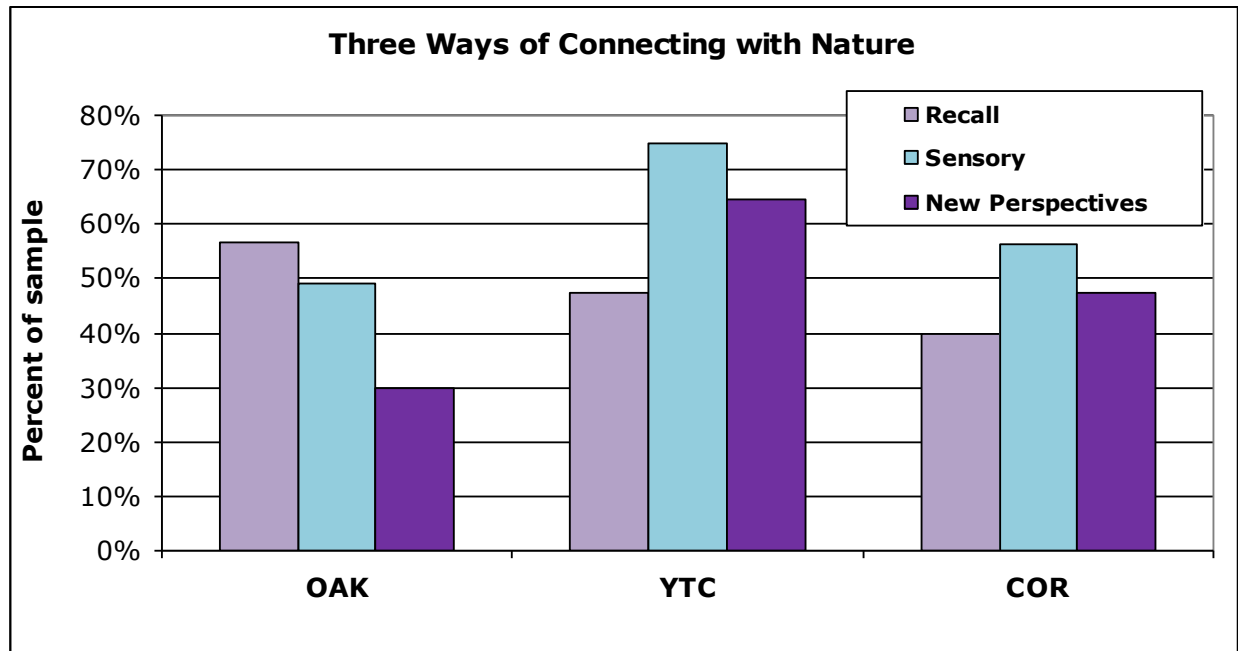
Here's the breakdown for each gallery area with the percentage of photo statements coded for all seven possible combinations.

Gallery area	Recall only	Sensory only	New perspectives only	R+S	R+NP	S+NP	R+S+NP
OAK	30%	19%	15%	21%	6%	9%	0%
YTC	3%	21%	10%	16%	11%	19%	20%
COR	18%	25%	18%	9%	7%	16%	5%

And the next table gives a summary of the codes for each gallery area overall, combining recall or sensory or new perspectives references when they were mentioned alone or in any combination. For example, in OAK, recall only was 30%, plus R+S 21%, plus R+NP 6%, plus R+S+NP 0% = 57%). The highest frequencies in each category are boldfaced.

Gallery area	Mentioned recall	Mentioned sensory	Mentioned new perspectives
OAK	57%	49%	30%
YTC	50%	75%	60%
COR	40%	56%	47%

Seen as a graph, the data look like this:



Trends and interpretation of the PC "ways" data

- OAK visitors had the highest percentage of recall statements, probably because most of the participants were area residents and more familiar with the local areas shown in the exhibits. OAK had the lowest percentage of new perspectives for the same reason: familiarity with the topics already.
- YTC had the highest percentage of sensory statements. Participants were reacting to the many animals and tableaus of habitats in YTC, being up close to them, seeing details. And YTC also had the highest percentage of new perspectives. Experiencing animals up close and using the labels and interactives led visitors to have new insights about things they already may have felt connected with.
- COR coded statements were spread more evenly among the three ways of making connections. COR had comparatively the lowest percentage of recall, probably because there were many exhibits that visitors were not particularly familiar with—many were new topics or new tools.

- YTC also had the highest percentage of statements that contained multiple ways of making connections (the combinations of recall+sensory, recall + new perspectives, sensory + new perspectives, and recall+sensory + new perspectives).

Gallery area	% of statements mentioning more than one way
OAK	36%
YTC	66%
COR	38%

The trend for YTC to have the “richest” combination of ways might be due to the richness of the modalities in those areas, plus the highest density of animal habitat exhibits.

So what does this all mean?

Overall, combining all three gallery areas and all 234 photo statement codes, the three ways of connecting were represented in these proportions:

- 50% recall
- 62% sensory
- 48% new perspectives

Several factors may at least partially explain the trends.

- People bring personal memories to the exhibit experience, so recall is a relatively easy and common experience. “Look, one just like...”
- The large number of exhibits and the variety of modalities (immersion, hands-on, video, iPads, living animals, objects, art, etc.) of the NSG provided a rich environment for visitors to explore, which led, not surprisingly, to a high number of sensory impacts.
- That almost half of the visitors’ statements showed evidence of learning seems quite high.

In reviewing these data on how people made connections, we should keep in mind the fact that these PC study participants were cued, highly motivated visitors who spent an exceptional amount of time in a limited area of the NSG by themselves with few distractions. The abundance of new perspectives may be a best-case scenario and is probably an exaggeration of the more typical experiences and outcomes for uncued, unpaid, time-limited, socially motivated visitors. Nevertheless, the data do show, encouragingly, that the exhibits are capable of affording lots of meaningful personal connections with nature.

Where people made personal connections with nature

We looked for visitors' personal connections and meaning-making in three areas in the Natural Sciences Gallery, which contained different topics and densities of exhibits. In this section, we will look at each area separately, examining which elements in each were photographed most often as places where visitors found personal connections with nature.

Each of the three areas will be discussed separately below. For a spreadsheet of visitors to each gallery and all the names of the individual photos they took, see Appendix 5.

Where people made connections to nature in OAK

OAK (Oakland)

Eleven people went to the Oakland zone, which contained 49 elements; they took a total of 83 photos of 41 elements. When asked to take a picture of the place or thing that helped them make a connection with nature in the OAK area, the Redwoods and "Land of Oaks" were the most frequently photographed exhibits.

<i>Exhibit name</i>	<i># of photos/mentions</i>
Redwood Platform and Goose Pen	10
Land of Oaks	10
Friends of Sausal Creek	4
Aquarium	4
Fort and video tree table	4
Mountain Lion	3
Bees	3
Oakland Hills Mural and Cases	3
Tree Rings	3
Campus Critters	3

There were other exhibits with fewer than three photos taken; for a list of all exhibits and the number of times they were photographed, see Appendix 5.

In the OAK area, there was a trend to connect to the sense of place, to Oakland—its history, its abundant parks, its iconic plants (oak trees, redwoods, grasses on hills), and opportunities for urban nature and recreation at Lake Merritt.

Below are some of the highlights of visitors' connections with the most frequently used exhibits in the OAK section. (Numbers in parentheses indicate subject ID.)

Redwood Platform and Goose Pen

Visitors loved the redwoods. They love them for their beauty, power, and strength. They like to go there to relax and de-stress. They enjoy the sounds, smells, and feelings of being among the trees.

Memories of my Dad taking us to the redwoods and seeing how huge they were. The smells; the beauty. (22 OAK)

I walk in these parks and feel that beautiful connection with the landscape itself, the way it smells, the damp, the green, the fog, the towering trees. Very romantic. (44 OAK)

Land of Oaks

The elimination of the native oak trees as Oakland grew made an impression on people

It's kind of interesting to see what used to be, all these Oak trees that used to be here... to see all the whole history, and the whole transformation of what became of Oakland. It's sad that we don't see that many Oak trees as before. (09 OAK)

When you see the pictures, you could see how much trees were cut down and roads were paved and buildings. And then when you get up to 8th and Madison, almost a hundred years before and now, it's really eye opening. So maybe the idea of nature is nature being gone. (25 OAK)

Friends of Sausal Creek

Visitors related to the urban nature of Sausal Creek and the community action to help clean up and rebuild the stream.

Our school takes place in a park that Sausal Creek runs through... It just feels like personally part of my everyday nature. (14 OAK)

Aquarium

Live animals, moving, and the connection with water were mentioned by visitors.

I think there's something just very beautiful about the flow of water and the sounds that were in that part of the room and the sight of the fishes swimming around in the roots. (44 OAK)

Fort and video tree table

Visitors remarked about the importance of getting children out into nature.

It made me think about connecting with nature with my family and with my community, both growing up and now. And I guess the value of having someone there to share that experience with. (73 OAK)

Mountain Lion

Visitors were surprised and scared to see the mountain lion up close.

Yeah, for that brief second I thought it was going to get me. I'm trying to remember if I'm walking on trails am I supposed to act like I'm bigger and taller and raise my arms? (25 OAK)

Bees

Bees and the health of bees were on the minds of visitors.

So the whole thing about bees and kind of being sensitive that we've impact [sic] bee population and how we can support its growth and health makes me feel like my relationship and interdependence in nature. (14 OAK)

Oakland Hills Mural and Cases

Visitors connected to the vastness and seasonal changes of this landscape.

This is our amazing California landscape... it's just amazing when it's brown, it's amazing when it's green. And you watch, it just like reflects the seasons right back to you, and swallows you up. (14 OAK)

Tree Rings

Visitors enjoyed the experience of looking at the tree rings through the magnifier.

Something about the physicality of that really close up view where you can get right into the rings and see the edge, see the bark, where the tree ends. I really like that. It seemed really tactile even though I wasn't touching it. (44 OAK)

Campus Critters

Visitors were reminded of familiar animals that we share space with.



I had to dig very deeply to try to appreciate the skunks. They're just trying to do their thing. (22 OAK)

Because most of the participants were from the Oakland area—some of whom were lifelong residents—they easily connected to the sense of place, and its history, parks, and hills were familiar. Many people had explored opportunities for urban nature and recreation at the redwoods and Lake Merritt.

Where people made connections to nature in YTC

YTC (Yosemite, the Tehachapis, Coachella Valley)

A total of 15 participants visited the YTC area. YTC contained 47 elements, including five dioramas, and visitors took a total of 96 photos showing 36 elements. When asked to take a picture of a place or thing that helped them make a personal connection with nature, in the YTC area, live animals were the most frequently photographed exhibits.

<i>Exhibit name</i>	<i># of photos/mentions</i>
Termites	9
Reptiles (alive)	8
Joshua Tree case	5
Sage smell interactive	5
Yosemite art	5
Bears	4
Condor	4
Mountain Lion diorama	4
Chaparral	3
Bighorn Sheep diorama	3
Eagles diorama	3
Tule Elk diorama	3

Other exhibits with three or fewer photos taken are listed in Appendix 5.

In the YTC area, there was clearly a trend to connect to nature through sensory experiences with the exhibits, often leading to new perspectives. Most subjects described getting a new vantage point on nature by getting physically up close to the animals and plants, seeing details and experiencing them in ways not possible in the wild (e.g., too far away, too dangerous, not able to ID them easily). The sounds and the specimen drawers were appreciated by many people.

Below are some of the highlights of visitors' connections with the most frequently used exhibits in the YTC section.

Termites and Reptiles

The live animals were most photographed. A common theme was surprise at seeing live animals in the exhibition and may have constituted "personal meaning in nature" for many people.

Yeah, this one took me off guard. Because I didn't realize there were live termites in there.... There was another exhibit that had live snakes and lizards so that kind of threw me off because I expected most of the exhibit to be, you know, not alive. (39 YTC)

I liked all of these [reptiles]; it was a surprise to see them. I thought that they were another display of stuffed, like taxidermy, and then they started moving. It kind of freaked me out. But it's a nice surprise to have in the gallery, to have something alive for once. (65 YTC)

But specific responses were very different for termites vs. reptiles. Most people took a close-up picture of the wood with termites, while three included the label in their shot. People expressed being both grossed out and fascinated watching them. Many felt lucky to get so close when the animals weren't a threat to them or their homes. At least seven responses described the benefits termites bring to nature, either generally or specifically.

No one described anything they had learned about the snakes and lizards. Instead they focused on the pleasure of seeing the animals alive at such close range. People described the reptiles as cute, beautiful, mesmerizing, gorgeous, or interesting. Some felt the animals were looking at them, or communicating something in the moment.



It pulled you in so you could see a snake eye to eye and not worry about it.... They didn't feel threatened either, I hope. (24 YTC)

Yosemite Art

"Yosemite" had very strong name recognition. All who used the word "Yosemite" also mentioned Yosemite Art, or My Yosemite. People also mentioned strong personal memories of visits there.

I just thought in general the painting was very beautiful but overall the piece I felt the most personal connection to nature is that small portion of the painting where the people are, camped out in the Valley. It made me feel the kind of serenity I feel when I'm in Yosemite. I would say I was kind of surprised by how connected I felt to nature just by looking at the painting itself. (23 YTC)

So for this one it's Half Dome and so I've been to Yosemite, actually more than once, but Half Dome has always had a draw to me to go and explore and perhaps climb it as well.... So it was a good reminder to kind of get back to that goal. And Yosemite is just so beautiful and this helped to encapsulate it a little bit. (50 YTC)

Joshua Tree

Subjects made connections with the place, but also indicated learning/observations about life in the desert, JT as a center of desert life, or the age of the tree.

I personally just think that Joshua Tree is really beautiful and I really like the landscape of the desert. But I didn't know they were like a basis for so much life. They help keep so many creatures alive. (116 YTC)

Sage smell

People talked about the value of smells in an exhibit and personal memories; no one mentioned the scene itself.

This was cool because one, I'm familiar with this bush and this smell which I think is beautiful. I love the smell of this bush. I learned something, I didn't know that some creatures by this smell know not to nibble on it. So I thought that was interesting. And then also I liked that it invited you to come in there and smell it. That really appealed to me to interact with it in that way. And it was so fragrant it was really nice. It really brought me memories of being in the desert. (45 YTC)

Well, I like this one. I like the sniffing, I mean I like multi-sensory input.... I've never actually smelled a sage brush. I'm not from California, so it was a very unusual smell to me. So I kept going back because I thought it smelled terrific. And it was really kind of nice to say hmmm, have I ever smelled this outside before? (88 YTC)

Bears

Trends included memories of encounters in wild; cuteness of cubs/scene and bears in general.

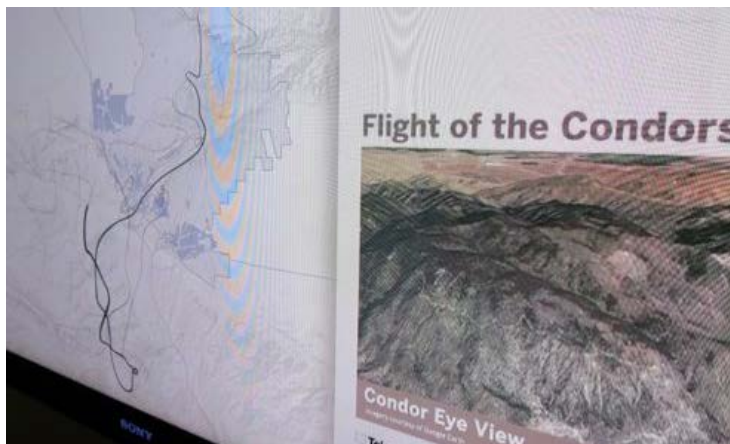
At the time when I saw the real bear I was actually scared, even though I was far away, so I appreciated this because, again, it gave me an opportunity to see something up close that I wouldn't experience when I'm actually out there. (23 YTC)

Condor

Comments about the condor were based on the bird specimen, the wall graphics, and the video of the flight.

Well I often see the condors in the sky so far away, so it was nice to look up and see it so close. It's the closest I ever want to be [laughs]. (24 YTC)

This one I thought was interesting because I love the point of view. I like the fact that you became the bird in the whole thing because I really, I mean I've seen that they have eagle cams you can see out that are made. But it was just really interesting to be the natural object and to say, kind of, where do they fly? (Flight of the Condor, 88 YTC)



Mt Lion

Visitors saw the mom and cubs as sweet and realistic, showing the predator-prey cycle.



This one was really nice because we often get so disconnected from, I guess, the general life cycle. Like, I forget what kind of animal that was, but, you know, something killed it... So I appreciated that it was like a full cycle because, especially for humans, it's, we're just so disconnected from it. So I imagine little kids looking at it and, you know, asking their parents if it was a dead animal and having parents describe what the process is. I think that was the main thing that struck me for this piece. (39 YTC)

Chaparral

I've seen the burning phase. And this really brings it up close and personal. You can almost smell the burning, the charred. So, you see a hillside burning from a distance, but this brings it really close and focuses on things that you normally wouldn't think about. For instance the rock on the bottom left corner. (43 YTC)

Eagles

It's just something I've never seen before. It's an action. So I felt I was watching something that happens every day in nature. (12 YTC)

Other dioramas that were mentioned by three people each were the Alpine, Bighorn Sheep, and Tule Elk. Some exhibits provoked comments about the vastness of nature, despite the ability to examine things close-up. The dioramas provoked this response often, particularly the Alpine, but also the Mountain lion, Eagle and Bighorn sheep.

In the YTC area, there was what seemed to be a sense of "biophilia"—people feeling an instinctive bond with nature, in this context, connecting to familiar and strange animals and plants in an easy and safe way. This instinctive bond was built upon by the many ways the exhibits offered sensory experiences and new perspectives—getting physically up close to see details, natural settings, and interactions with other organisms in the dioramas and scene cases.

Where people made connections to nature in COR

COR (Cordell Bank)

Nine people visited the Cordell Bank gallery, which contained 29 elements. They took a total of 55 photos of 25 elements. When asked to take a picture of the place or thing in the COR area that helped them make a personal connection with nature, the “crime-scene albatross” topped the most frequently photographed exhibits:

<i>Exhibit name</i>	<i># of photos/mentions</i>
Albatross with plastic	7
Theater	6
Reef case	5
TOPP	5
Elephant seals	3
Cordell topo and upwelling	3

Other exhibits with three or fewer photos taken are listed in Appendix 5.

In the COR area, there was a trend for people remarking on how human actions have affected animals (mainly plastic trash in the ocean, inside an animal, on the beach). More people who visited this section mentioned that an element motivated them to “do” something, e.g., engage in outdoor activities, take action to protect the environment or animals, learn more about a topic, or bring someone else to see the exhibit.

Below are some of the highlights of visitors’ connections with the most frequently used exhibits in the YTC section.

Albatross with plastic

People commented on the exhibit technique of showing a damaged animal as well as being impacted by the story.

I felt a personal connection to nature from this picture because I saw the litter, you could actually see the litter had been in the bird’s stomach and probably caused him to die and I just connected to it because when you’re walking in places outside you often see people’s trash and then you see the birds. You don’t necessarily connect that they would be eating the trash. (51 COR)

Theater

The theater was unusual in that all of those who photographed it related their feelings of “connectedness” to how the plants/animals were depicted (i.e., the display techniques) or their own existing familiarity and interests.

There was something about the slow way [the whale] was moving, the fact that it was just sort of one continuous image across the whole screen, instead of multiple ones and then the image changed and the whale took up the entire screen, and that was really cool and impressive because the screen wraps around.... (32 COR)

I just really love cephalopods. Like I'm completely obsessed with squid, octopi, cuttlefish. I've watched every nature show there is out there on them. Some of them twice. (94 COR)

Reef case

The stunning properties of the reef case attracted people, and those with personal interests in diving made connections with other underwater places.

This had a lot to do with just the sheer beauty and vibrancy that just made me appreciate the varied looks of nature and the different forms it takes and colors—it's stunning so seeing that up close was really cool.... It's a new take on things I've seen similar to this. I've been diving in the Great Barrier Reef. (94 COR)

I think this made me really want to go diving; I wanted to go see the reefs. Maybe that's something me and my sister could do. (34 COR)

TOPP

This exhibit was a familiar concept in a new media, which impressed many people and gave them a new perspective.

I have always wondered how they track animals, so, kind of never seen anything like a device they use to track them. So I found it very interesting how they put them on top of the turtles to track them. How it's able to track how far they go and things like that. (34 COR)



So this is the map of migration, I think it just gave me a new perspective, a visual perspective, something very easy to read about something I don't typically see or hear about, it's a simple pretty visualization of something. (94 COR)

I thought maybe I could look more into that and how they track different animals. (34 COR)

Elephant seals

Size, getting up close and realness again were impressive. One person had seen them up close in the wild.

I liked this a lot because I think it's done to size, if I am not mistaken, which, I haven't really seen elephant seals up close, but when you stand next to it, it reinforces this sense of wonder: oh these animals really are humongous. (32 COR)

My connection to this, it reminded me very much of those field trips I took in high school.... We were able to get a little bit closer back then than you're able to today, I understand you don't want to stress them out. I'm grateful for that colony has continued to succeed and be successful. (47 COR)

Cordell topo and upwelling

Most people stopped at the Cordell topological map, which was not situated in the middle of the room as were the other orientation topo maps in the other sections, where many people missed them. Three people photographed the Cordell Bank topo and the nearby upwelling exhibit, noting its importance both for orientation and for content.

I really just liked the diagram, that you could physically see the kind of drop of the reef. So I felt pretty connected because when I was in the exhibit I kind of had a hard time picturing where it was, and I sort of went past this, and when I went back through I saw this and it kind of made me connect more to the place. (51 COR)

My father's family immigrated to Berkeley in 1897 from Portugal, as fishermen, from the Azores. ... This picture reminded me of how fortunate we are to have such upwelling of nutrients to be able to recover from our past negligence in properly managing our fisheries. (47 COR)



From the negative feelings around plastics, to people's associations with individual species, and the positive emotions in the theater, Cordell Bank presented a range of sensations that did not cluster into one "sense of place" for the whole area. Instead, participants gained a sense that the place existed—for many had never heard of it—and the megafauna (large fishes, elephant seals, video-projected animals) gave them their connection with nature.

Most and least photos

The photos taken by participants in the PC study were not evenly distributed over all the elements in the areas (OAK, YTC, COR). In each area, two elements were photographed by more than half the people.

The most-photographed elements were all high sensory experiences:

- The romance and immersion of the redwoods (sounds, smells)
- The loss of the Land of Oaks (photos and maps of how it used to be)
- Surprising live animals—Termites and Reptiles
- The tragedy of the albatross filled with plastics
- The trance of the Underwater Theater

Visitors did not make connections (i.e. take photos) with about 20% of the elements, which tended to be low sensory (not eye-catching, at least from a distance) or they were skipped or missed by PC visitors who didn't even stop at them. YTC was the area with the highest percentage of elements that were not photographed. iPads were not photographed.

For a spreadsheet of visitors to each gallery and all the names of the individual photos they took, see Appendix 5.

Did the participants in the PC study see evidence of human impacts?

For each photo that a person took, interviewers asked, "What was it about this that helped or made you feel a personal connection with nature?" At the interview's close, visitors were asked if they'd seen any exhibits about human impacts, even though many people had already mentioned something about this in their "connections" discussions. The answer was "yes" in all three areas (OAK, YTC, and COR).

Visitors definitely noticed exhibits that dealt with human impacts on nature, often in ways that were similar to the ones we've already heard in the ST and CQ data. But the PC participants were more likely to elaborate or be very specific about which exhibits held this message.

Some said human impacts or the theme of change was everywhere in the exhibition and made general remarks about how important it was to talk about it.

I'd say 75 percent of the exhibits tied in to human impact on nature. (43 YTC)

I think that it's good to have an exhibit that's actually in your face. Maybe actually could be a little more. Although I understand that there's a fine line. You don't want to scare people away. But you want to inform and educate but not freak people out. (101 COR)

They realized something about human impact and were motivated to respect the environment more or take action to protect environment or animals. Some wanted more.

There was no call to action. It was just like, hey, here's stuff we're destroying. But if I wanted to do something or you know, the lead thing, I wasn't sure how the lead was getting into the condors so it was like, so? I don't know what I could do differently. Or change anything. I don't know if there's something one could do as far as what kind of laws, or conservation organizations you could get involved with. I want a huge, you know, 'and you can help!' Especially if I was a kid, which I'm not, or if I had a kid, which I don't, but. You know. (88 YTC)

Some people described specific stories they recalled about human impact from the exhibit.

I was reading the timeline and the condor map. There was this huge thing to bring condors actually like 22 of them to different zoos. That's something I've never heard about. (04 YTC)

There were the jars containing the combs, and the razor blades and the bottle caps. The bottles floating in the ocean as an overhead, those had quite an impact. (47 COR)

Some mentioned specific man-made objects that they connected to "human impact"—the truck, cranes in Oakland harbor, fire, the cabin, road signs, fence, plastics.

The striking one was the culvert. I was very interested by the streams that run through Oakland and the ones that are underground and the ones that aren't. That was very interesting because the hidden streams are something us homeowners are always dealing

with. Because I'm telling you one of those runs under my house, so, I deal with it. And then of course I saw the road kill installation, and the other one was the Oaks and how the oaks are going away. That's something I think about a lot and I really like the old pictures that showed how many trees there used to be. I kind of wish I could put Oaks around my house. (44 OAK)



And a few people said that they noticed things but purposefully avoided looking at them. I might have skipped over some of the exhibits or photos, but it's important. There were certain things that were a little too painful for me to look at. I don't remember any because I subconsciously didn't want to look, if that makes sense. (22 OAK)

Another theme that came out of PC participants' interviews about their photos, that we've heard before in the ST and CQ data, was that of action. They wanted to do something, and it often came in the form of a new perspective and seemed to be more often in the YTC and COR than OAK.

I've been hiking through I guess scrub brush like that and it provided extra information visually that I didn't know hiking through that type of climate. So next time I go hiking I'm probably going to start trying to look for those animals. (43 YTC)

These animals, their natural habitat is the highest altitude in Yosemite. And so they don't have anywhere else to go.... And now when I go back to Yosemite, now that I know that they're there [pica], I want to look for them. I'll keep an eye out for them. And so in that regard I feel a personal connection to nature. (23 YTC)

Knowing something like that helps me to be more conscientious about, for example, practicing the "leaving no trace" principle when I'm backpacking. It makes me more conscious about, for example, in my own charitable giving, the kind of causes that I donate to. (23 YTC)

I teach, so reminded me what I wanted to show my kids. Maybe we should talk about more environmental causes, we don't really touch on that too often, and so we should probably do that. (86 COR)

I thought maybe I could look more into how they track different animals. (34 COR)

I think this made me really want to go diving; I wanted to go see the reefs. Maybe that's something me and my sister could do. (34 COR)

The change in the tides and the temperature of the water changes the feeding conditions and they respond. So that was very interesting. I'd like my grandsons to see the exhibit because they both are very science oriented. (01 COR)

I visited Diamond Park and learned about all their clean up efforts. I never would have imagined that a creek as running through such an urban part of Oakland. I liked that it highlighted the different community actions that were being done because that is a way that I feel I am able to connect with nature in Oakland is to participate with clean ups, shore clean ups and stuff like that. (73 OAK)

If I'm walking on trails [with possible predators] am I supposed to act like I'm bigger and taller and raise my arms? (25 OAK)



SECTION 4. COMPARISONS AMONG FINDINGS IN ALL THREE STUDIES

Visitor background data

The largest portion of the ST and CQ data was collected on Thursdays and Fridays.

Day of week	ST (N=103)	CQ (N=60)
Wednesday	31%	0%
Thursday	21%	40%
Friday	48%	35%
Saturday	0%	25%
All visitors	100%	100%

Females made up more than half of the samples in all three studies, but the proportion was larger in the PC study.

Visitor gender	ST (N=103)	CQ (N=60)	PCS (N=35)
Female	63%	57%	74%
Male	37%	43%	26%
All visitors	100%	100%	100%

There were more adult-only groups than groups of adults with children in all three study samples.

Group type	ST (N=103)	CQ (N=60)	PCS (N=35)
Adult-only	68%	62%	100%
Adults & children	32%	37%	
No data	0%	2%	
All visitors	100%	100%	100%

First-time visitors to the NSG outnumbered repeat visitors in both the ST and CQ.

First-time vs. repeat visitors	ST (N=103)	CQ (N=60)
First-time visitors	69%	75%
Repeat visitors	31%	23%
No data	0%	2%
All visitors	100%	100%

Special interest

People without any special interest, knowledge, or training in natural science outnumbered those with a special interest in the same proportions. One-third of all visitors described a special interest.

Special interest	ST (N=103)	CQ (N=60)	PCS (N=35)
No special interest	63%	68%	66%
Special interest	36%	32%	34%
No data	1%	0%	0%
All visitors	100%	100%	100%

Those who did have a special interest in all three studies named these factors, in this order from most common to least:

- Had studied biology, ecology, botany, etc., in school
- General interest to enthusiastic interest in nature
- Job-related career or profession, educator or teacher
- Hobby or leisure activities
- Live near water, bay, mountains
- Volunteer at a museum

We are not sure how these demographics compare to the overall visiting audience to the OMCA because we did not have any general visitor surveys to compare our data with.

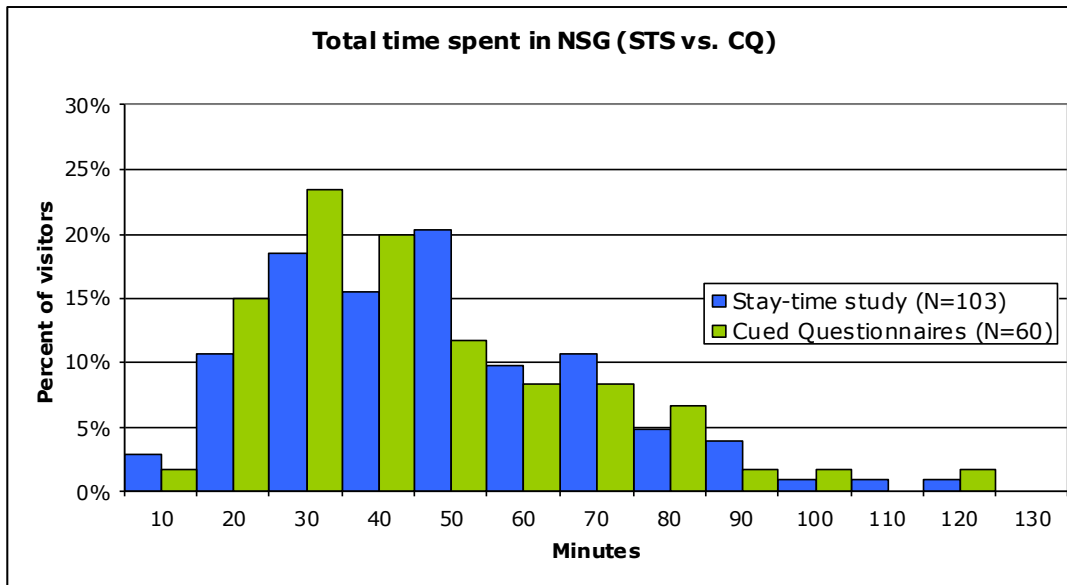
Time spent in the exhibition

The subjects in all three samples were cued to some degree, that is, they knew they were going to answer some questions with the evaluators after their visit. Usually cuing prompts people to spend more time in an exhibition—especially in smaller galleries, but in large spaces, the effect of cuing is null (Serrell 2001).

PC participants were limited to one area of the NSG where they spent the suggested 20 minutes. Almost all visitors finished looking and taking photos within 20 minutes. Only one person in OAK was so diligent that she only saw the exhibits on the left side of the zone. In Cordell Bank many people made two loops around the area in that time.

The participants in the ST and CQ were allowed to spend as much time as they wanted in any or all areas of their choice. We know how long they stayed but did not watch where they went. We know some of what they engaged with from what they said.

The average time spent in the NSG by the ST and CQ subjects was virtually the same.



The average time spent in the NSG by the ST was 44 minutes and CQ subjects spent 42 minutes, virtually the same total time on average.

It takes time to see more

When we compared which elements PC visitors talked about we found that for the most part the same things captured the attention of the people in the ST and CQ studies—redwoods and oaks were mentioned, as were the albatross and the theater. However, unlike the PCs, no STs or CQs said anything about the termites. ST and CQ visitors undoubtedly sampled the exhibits less diligently—spending an average of 40 minutes in the whole 25,000 square feet. PC visitors, who had a full 20 minutes to investigate just one area and engaged with more elements; and some of YTCs found the termites hidden in a corner and were surprised.



SECTION 5. CONCLUSIONS AND DISCUSSION

This section will review the intended outputs and the intended impacts or outcomes for visitors. We will also discuss the new research findings from the intense analysis of the Personal Connections data, as well as take a critical look at the fidelity of the final exhibition to the original goals of the National Science Foundation grant application. The section concludes with a few highlights about the usefulness of the information in this report for the OMCA and for the natural history museum community at large.

Intended Outputs

The 25,000 square-foot NSG is a strong overview exhibition about the natural history of California. It presents familiar and unfamiliar places, animals, habitats, and conservation issues. It introduces human impact on nature as a main theme throughout the different sections with exhibits that range in their shock value—from squashed road kill and an albatross filled with plastic, to the science of alpine chipmunk population distributions over time. The NSG is clear in its intent to communicate today’s environmental challenges as well as the more familiar natural history interpretations of adaptations of animals to their habitats.

The gallery affords multiple opportunities for visitors to use their senses and new tools—to smell sage or redwood, look through a microscope at the details of a bee, to track the migrations of sharks, or create the optimal conditions for upwelling on Cordell Bank. The combination of traditional cases and dioramas with large graphics and interactive exhibits provides a stimulating and interest-provoking free-choice learning environment.

The main idea of diversity is a must-have message for natural history exhibits, and it is apparent in the new NSG, as it probably was in the old one, too.

As with many exhibitions, there are some challenges involving orientation. The NSG is one of the three main galleries of the OMCA, but may be the least-visited because of its location. The outer lobby door is not easy to find or see, and the special exhibits area just inside the NSG entrance is confusing for first-time visitors. The introductory area and exhibits (wall text, art, Grizzly Bear mount, Bristlecone pine and geology video) are a mixture of themes that do not strongly reinforce the NSG organization or main messages.



What was the “Big Idea”?

The big idea of the NSG is:

“California is a place of incredible biological diversity that is under threat, and you can help save it.” This was identified as the big idea in the June 2013 Advisors Report and in our discussions in April 2014. The subject of the big idea is California.

The original big idea in the NSF grant proposal was different. It was, “Five places (Oakland, Sutter Buttes, Yosemite, Joshua Tree, and Cordell Bank) in California—a ‘hotspot’ of biological diversity in the world—are threatened by increasing human activities which can be mitigated by people like yourself in immediate and long term actions by citizens, government, and industry.”

The original subject was the five places, not just California. During exhibit development, Mt. Shasta was added, and Joshua Tree apparently was split into Coachella Valley and the Tehachapis—an term unfamiliar to most visitors—making the places total seven. The “so what” of the big idea—that the threats to the five places can be mitigated by citizens, government and industry, was shortened to “you can help.”

Both the shift to a more general subject and the inclusion of two more places (one of which was not a place in the same sense as the others) seems to have diluted the original premise of the exhibition. This point had been made earlier by the Advisors as well.

Audience Impacts—Outcomes

The summative evaluation strategies—the Stay Time, Cued Questionnaire, and Personal Connections studies—looked for evidence for the degree to which the intended experiences and messages were being communicated.

The summative evaluations provided evidence that many people got the big idea. They used the word “variety” and “different kinds” or “vast array” and “diversity”; they named the various human impacts on nature in California; and they talked about ways that they could help. They were able to hold the two thoughts at the same time: nature is cool and humans are making a mess of it (evaluator’s words).

In all three studies, speaking very broadly, the data revealed that visitors perceived the NSG exhibits were to show nature in California—wildlife, animals, habitats, environments, and about its variety and to make people understand, be aware and appreciate nature and care about it. Visitors were aware of the human impacts in the exhibits in all sections of the NSG. In all three studies, many people talked about how California had changed as a result of human encroachment and habitat destruction, and how we have to help preserve and take action to protect, preserve, and enjoy nature.

While there is ample evidence that visitors grasped the messages about nature, human impact, change, and how we can help, the climate change message and the organizing

message about the seven real places were two communication goals that were not strongly achieved. In large exhibitions like this one, with multiple main messages, this is not a surprising finding, because the presentation of so many ideas in so many exhibits can be an overwhelming experience. Even though the ST and CQ visitors were cued, they were mostly first-time, time-limited, visitors who probably had a social agenda rather than a strictly educational one, and who, therefore, were not working hard at keeping the various themes clear in their minds during a 40 minute (on average) self-guided tour. Out of all the possible things to do in the NSG (at least 150 distinct exhibits), most STs and CQs probably sampled less than one-quarter of them.

Seven real places—A missed opportunity

The “seven real places” theme appeared in multiple places in the exhibition. It was introduced in the introductory wall label; in the welcome area, it was shown on the large topographic map with accompanying graphics; and it was portrayed on a small, stylized floor plan of the NSG. Then, in each of the seven places there was a kiosk map usually in the center of the room where the place was discussed with graphics, text, and a topographic map of the area. Data from our studies did not show evidence that visitors used this framing message.

There was a missed opportunity to present the boundaries of all seven different areas more clearly. Oakland, given the largest square-footage, the most exhibits and the prominent first place, was successful in establishing a sense of place because most visitors in these studied walked in with a sense of it already. Cordell Bank had walls that unmistakably marked its real estate as a separate area. Sutter Buttes had a huge wall mural that spoke to its remarkable geography. Mt. Shasta had a strong story about water. But Yosemite and Coachella were not as distinct and seemed to merge together, and the Tehachapis was apparently not seen at all. People mentioned Joshua Tree specifically and lovingly.

Without the “seven real places” theme in mind, visitors missed the opportunity to develop a greater understanding of the unique differences between these places, their special characteristics, and the particular ways scientists are studying them, or how the communities who live there are engaged in conservation practices. Visitors got the big messages on a general level, and got some particular details from areas and exhibits they engaged with, but they missed the middle message about the conceptual layout of the gallery areas.

Research outcomes from the PC study

Trends that emerged from visitors’ photo statements in the PC study showed that visitors often made connections with nature through Sensory ways. Using their senses (seeing up close, smelling, hearing) and responding to the immersive exhibitry and technology were often the entry points for visitors that could lead to New Perspectives. Sensory ways were the most common ways that visitors made connections in YTC and COR where people had more exciting and impactful experiences. In OAK, Recall statements were the most common

way people made connections there. They brought their familiar ideas with them (been there, done that), and some people didn't move beyond that to make new generalizations for themselves. For example, "I've seen skunks in my backyard" is recall; "Oh, there is nature in my own backyard" is a new perspective. So familiarity and recall can have a benefit, in that visitors easily recognized many things in Oakland, but the negative was that visitors stuck to it.

Value and use of NSG summative data

There are many findings from these summative evaluation studies that can be useful and valuable to NSG project stakeholders and for adding to our knowledge about how and what visitors learn in natural science exhibitions, as well as for informing future practices.

Knowing the stay time and how diligent visitors used the NSG

The average total time spent by the ST and CQ visitors was approximately 42 minutes, which suggests that visitors are probably using the NSG incompletely, which is not unusual for large, permanent exhibitions. They are typically sweeping through the exhibits rapidly, not diligently. The hope, of course, is that people will come back again, see more of it or spend time in areas where they had not on a previous visit. "We'll do that the next time we come." Time-and-use studies suggest that repeat visitors do spend time in places that require a higher time investment, such as a lab area or a film or an open-ended interactive (McNamara 2010). They might spend the same total amount of time but distribute the time in a different way, spending more time on fewer things. But studies also suggest that repeat visitors will re-visit favorite places, often showing around friends who are first-time visitors. "Don't miss this! It's really neat!"

The demographic data showed that the majority of ST and CQ visitors were making their first visit to the NSG. Large permanent galleries such as this one should be designed with clear orientation and easy to understand choices for visitors to enable them to make the best use of the time they have, either by spreading it out over the whole area to get a quick overview, or to chose to spend more time—to be diligent visitors—in the area of their greatest interest. Either way, the interpretive strategies need to work for a broad range of ages, abilities and time-budgets.

Knowing what visitors found personally meaningful and memorable in the NSG

Now that the OMCA has a better idea of what visitors remembered about the NSG, exhibit developers can tweak the interpretive strategies for those places that are popular (e.g., live animals, Cordell video) to make them work even better for a broad range of ages and abilities. For example:

--The termite label could be a little longer and more graphically attractive to let visitors know that this is a special thing and to answer more of the questions they had about them.



- More comfortable seats for adults and seniors should be added in the Cordell Theater.
- Putting up a barrier in front of the live reptiles is the antithesis to this. Better to rotate the animals on and off exhibit than to deprive visitors of the up-close-and-personal experience that they valued so highly.

There are also many opportunities to make effective but low-attraction exhibits work better, such as:

- The creek map impressed many people who stopped at it, but many others missed it because of its location in the culvert. The culvert feels like a passage to be flowed through, without stopping, which can block traffic.
- Make the beach wrack label easier to understand. It is such an interesting concept, and "detritus" is not defined.
- Let visitors know the clever behind-the-scenes mechanism of how the Cordell Bank "rover" works.

In all interpretive materials added and/or updated, keep the information linked to the big idea and the main messages, not just about how animals are adapted to their environments.

Knowing how people made connections with nature in the NSG

We learned the three ways about how people make and feel connections with nature—Recall, Sensory, and New Perspectives. These can serve as interpretive guidelines for enriching visitors' experiences in any natural history exhibits. When planning exhibits or doing front-end and formative evaluation, developers can ask themselves, "What is it about this object, photograph, diorama, video, etc., that can link to people's memories?" "What about this exhibit might be enhanced by enabling visitors to see it more closely, in more detail?" "How can we interpret this exhibit in a way that will build on people's recall and sensory experience to help them get a new perspective, a new realization?" This is not a radical new finding exactly but conceptualizing it in this more organized way will be useful for making exhibitions more visitor-centered, not just adding more facts.

Next steps

There is a lot of rich and interesting data in visitors' open-ended questionnaire responses and the often-amazing things that the Personal Connections participants said about the exhibits they photographed and found meaningful that we did not have time to cover in this report. Other researchers will find even more to mine in the raw data in the Appendices.

Another study that could be done to round out the NSG data is to do tracking in the two areas that were not included in-depth here, Mt. Shasta and Sutter Buttes. Learn where the popular spots are in those areas to get a more complete picture of the whole gallery.

Thanks

Many heartfelt thanks to Mary Faria, Sean Olson, Don Pohlman, the data collectors, the OMCA staff, and all the visitors who gave their time and attention to this project.

APPENDICES

Appendix 1: Detailed Methods for Three Studies (ST, CQ, PC)

Appendix 2: Stay-Time Study Data

Appendix 3: Cued Questionnaire Data

Appendix 4: Cued Questionnaire NSG Goals Analysis

Appendix 5: Personal Connections Study Data

All appendices are in separate electronic files.

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