



Habitat Dioramas and Sense of Place: OMCA Natural Sciences Gallery

Summer 2014

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Executive Summary

Sense of Place is a complex concept addressed within many academic disciplines, including psychology, geography, anthropology, and architecture. Ardoin (2004, 2006) defined Sense of Place as “the complex cognitive, affective, and evaluative relationships people develop with social and ecological communities.” Some research supports the view that developing a strong sense of place can lead to environmentally responsible behaviors (e.g., Kudryavtsev, et al., 2012).

As part of the Oakland Museum of California’s (OMCA) *Hotspot California* project funded by NSF, Garibay Group conducted research investigating whether habitat dioramas contribute to visitors’ development of Sense of Place. The main research question for the study was: *What role does sense of place play in visitors’ experiences with habitat dioramas?*

Garibay Group’s initial study as part of the project involved research at the Field Museum in Chicago and the Denver Museum of Nature and Science (Garibay Group, 2013). In Spring/Summer 2014, the study was extended to OMCA, with data collected at four dioramas (referred to here by the place they represented, Yosemite, Coast Ranges, Central Valley, and Coachella) in the renovated Natural Sciences Gallery. This report discusses findings from OMCA; it extends the research to a new museum with a new set of dioramas, allowing us to further investigate how earlier findings compared to those at OMCA and the extent to which results might be generalizable. The OMCA portion of the study followed the same design and set of instruments as the initial study (see, Garibay, 2013). The primary data for answering the research question were gathered via a Sense of Place questionnaire developed specifically for this research (N=234). Additionally, we also conducted 15 purposively sampled observations and interviews in the *Natural Sciences* gallery to triangulate findings, and included two survey questions to summative evaluation questionnaires conducted by Serrell and Associates (N=103).

Key Findings

- Place Bondedness was measured as the mean score of six statements about respondents’ potential connections to the place shown in the diorama. Each statement was rated on a 1-5 scale, with higher ratings indicating higher levels of agreement. OMCA respondents expressed some feelings of Place Bondedness for the places depicted in the dioramas in this study, although the degree of Bondedness varied. The Yosemite Alpine diorama received a mean score of 2.95 and median score of 3.00. The Coast Ranges diorama scored slightly lower, with a mean of 2.88 (median 2.83). The Coachella desert diorama scored even lower, on average (mean 2.57, median 2.50), and the Central Valley diorama had the lowest average Place Bondedness scores (mean 2.35, median 2.17).
- As in the earlier study, results suggested that Bondedness for the sorts of places depicted in habitat dioramas develops through interactions between several positively related factors, including visits to the specific place depicted or places that seem similar and overall familiarity with the places portrayed in the dioramas. However, results for the Central Valley diorama suggested that, for some natural habitats, familiarity and even repeated visits do not always lead to greater feelings of Place Bondedness.

- Results from the Central Valley diorama were an important contribution of the OMCA portion of research. While the available data do not allow us to identify the reasons for the difference in results, the data have identified an additional factor that needs to be accounted for in understanding the factors that lead to Place Bondedness. We hypothesize that this factor may have to do with something of an affective nature—a factor that might be termed Aesthetic Preferences, Likeability, or something similar. This area is, of course, ripe for further research.
- Despite the lower Place Bondedness scores for the Central Valley, respondents reported that they read and learned about the Central Valley diorama at levels comparable to the other three dioramas in this study. Thus, lack of connectedness does not necessarily lead to an ineffective experience. In fact, OMCA respondents' respondents reported that they learned about all the places portrayed in the selected dioramas, regardless of their Place Bondedness scores.
- Responses to the two questions included in the front-end studies for the Natural Sciences Gallery (Garibay Group 2008a and 2008b) were compared to data for these same questions, which were included in the summative evaluation.
 - The first item asked visitors to rate the statement, "I was able to personally connect with some of the natural places portrayed in this gallery," using a 1-to-4 scale, where 4 indicated the strongest level of agreement. Agreement ratings were higher for this item for the renovated gallery than the original gallery, with 69% of respondents selecting a "4" (highest level of agreement possible) compared to 60%. Comparisons of the pre- and post-sample differences were statistically significant at the 0.03 level using an independent-sample Kruskal Wallis Test.
 - The second item asked visitors to react to the statement, "My visit to this gallery today got me to reflect about nature in California," again using a 1-to-4 scale. Agreement ratings were higher for this item for the renovated gallery than in the original gallery, with 77% of respondents selecting a "4" (highest level of agreement possible) compared to 56%. The comparisons of the pre- and post-sample differences were statistically significant at the 0.002 level using an independent-sample Kruskal Wallis Test.
- There was evidence in the OMCA results that both Visitation and Familiarity with Place may, to some extent, be influenced by experiences at natural history exhibitions. Respondents in our sample indicated that their diorama experiences made them feel like they wanted to visit many of the places depicted in the dioramas, and they said they learned about all four places from their experiences at the dioramas.

Overall, this exploratory research found that many visitors did feel connections to the places they viewed in diorama halls and the extent of those feelings varied in ways that seemed to be somewhat predictable. There was also evidence that both visitors' experiences at dioramas and the outcomes of those diorama experiences were related to their feelings about the places those dioramas portray. A range of factors contributed to (and may be in turn affected by) visitors' feelings of place bondedness for the places portrayed in dioramas. These include previous visits to the place portrayed or to places that seem similar to it; feelings of familiarity with the place; aesthetic and other affective reactions to the place, or to the way it's portrayed in the diorama; and overall connectedness to nature (in a non-place-specific sense).

Introduction

Funded by the NSF, the *Changing California: Gallery of California Natural Sciences* Gallery features seven California locations with high biological diversity, places that are threatened by complex environmental issues. Its revised interpretation emphasizes the personal connections that people develop to the natural and human aspects of those places.

The redeveloped *California Natural Sciences* gallery focused on the biodiversity of California and included dioramas as well as a range of other types of exhibits (e.g., hands-on interactives, computer-based experiences, videos). In addition to more traditional dioramas¹, mounted animal specimens were also displayed in freestanding small vitrines with sections of recreated habitat. Some sections of the exhibition included live reptiles or fish, and most included videos and other multimedia displays showing wild creatures and their habitats. A variety of constructions were used to give visitors a feel for the places being discussed, from recreated forests to crawl-through lava tubes to a Yosemite Lodge-like building with a wrap-around porch and rocking chairs.

As part of the Oakland Museum of California's (OMCA) *Hotspot California* project, Garibay Group conducted research, which investigated ways in which habitat dioramas contribute to visitors' development of Sense of Place. *Sense of Place* is a complex concept addressed within many academic disciplines, including psychology, geography, anthropology, and architecture. Noting that each field often defines the term too narrowly based on its individual discipline, Ardoin (2004, 2006) developed a multi-dimensional definition of sense of place as describing "the complex cognitive, affective, and evaluative relationships people develop with social and ecological communities." Some research supports the view that developing a strong sense of place can lead to environmentally responsible behaviors (e.g., Kudryavtsev, et al., 2012).

The overall research question was:

What role does sense of place play in visitors' experiences with habitat dioramas?

The sub-questions guiding this research outline the aspects of the experience investigated:

- *Do visitors experience feelings or connections of the places they view in diorama halls?*
- *How do visitors' feelings about place affect their experiences at habitat dioramas and what roles might place-related feelings play in the outcomes of the diorama experience?*
- *What factors contribute to visitors' feelings of place bondedness?*
- *What role can museums play in initiating or deepening visitors' feelings for the places portrayed through dioramas?*

¹ The term *diorama* as used in this study is based on Wonders' (2003) definition: "Habitat dioramas are museum exhibits of stuffed animals set in an imitation of their natural environment" (p. 89).

The initial study involved research at the Field Museum in Chicago and the Denver Museum of Nature and Science (Garibay Group, 2013). Results from the initial research revealed that dioramas inspired memories and connections to place. A complex set of factors contributed to visitors' feelings of Place Bondedness. Visitors expressed the strongest connections to places that felt most familiar to them—even if they had not visited them previously.

The study discussed in this report is a continuation of this earlier research. It extends the research to a new museum with a new set of dioramas, allowing us to further investigate how the OMCA results compared to earlier finding and the extent to which results might be generalizable. The research questions and primary data collection instruments remained the same as the previous study.

OMCA's *Changing California: Gallery of California Natural Sciences* exhibition provided some interesting contrasts to the two museums included in our earlier study. Both the Field Museum and Denver galleries had dioramas as the major focus of the exhibition. Both exhibitions had been redeveloped about 20 years earlier to include additional interpretation and interactive components as supplements to much older dioramas (some more than 100 years old). The Denver museum's exhibition was entitled, *Explore Colorado*, and like OMCA it used place as a major focus of the exhibition. The Field Museum's dioramas all portrayed places in the Americas, some very close to the museum and some thousands of miles away; however, place played a relatively minor role in the interpretation of these dioramas. In contrast, the OMCA Gallery included dioramas, but they were not the sole components of the exhibition.

Connecting to Places Shown in Dioramas

A literature review undertaken during the first phase of this research project investigated the outcomes at of visitors' experiences at habitat dioramas (Gyllenhaal, Garibay, and Schaefer, 2010). The literature review found that a large number of learning-related outcomes had been ascribed to the diorama experience in museums, and that some claims about diorama outcomes had been well supported by research and evaluation, but others had not. Although the literature about the extent to which dioramas fostered connections to places was very limited, findings indicated that when interviewed after their diorama experiences, some visitors were aware of or connected to the places shown in habitat dioramas. The available evidence suggested that dioramas that depict familiar natural areas stimulated visitors' pre-existing sense of place (Gyllenhaal, Garibay, and Schaefer, 2010).

For example, as part of a front-end evaluation conducted at OMCA's Natural Sciences Gallery prior to renovation of the Gallery, Garibay (2008a) found that visitors seemed to have developed, or were developing, relationships with the wild places depicted in the dioramas. Two-thirds of respondents in that study gave answers suggesting that they recognized that the gallery was California-specific, and that most visitors agreed that they felt connected to places shown in the dioramas. Also, repeat visitors to the Gallery provided significantly higher ratings than first-time visitors. Nearly 60% of visitors indicating

feeling a connection said this was because they had been to that specific place, seen an animal or plant portrayed in the diorama, or had an interest or memory relating to these places. In other words, OMCA visitors made links between habitat dioramas and places that had meaning to them. Findings, however, indicated that other respondents in the OMCA sample thought of the Natural Sciences Gallery in more general terms—as “nature” or as places where animals live, rather than as natural places that might hold personal meaning for *them*. Thus, while there was evidence that dioramas can stimulate visitors’ pre-existing sense of place—especially for frequent museum visitors—it was not known the extent to which dioramas helped visitors *develop* their sense of place, especially for places where they’ve never been. The front-end evaluation concluded that, although the sense of place outcome seemed like a useful lens to view the diorama experience, more research specific to dioramas was needed (Garibay, 2008a).

Initial Study Instrument Development

Several valid and reliable scales exist to measure sense of place. We identified 11 validated instruments that could potentially be adapted for our research and ultimately selected scales developed by Hammitt, Kyle, & Oh (2009). Scale items were grouped into five aspects measuring sense of place, which the authors termed *Place Bondedness*. Since these scales were developed for respondents who were known users of a particular place’s natural resources, we needed to adapt instruments for use in museum habitat diorama halls. The final instrument developed included 11 questions (in the form of statements) taken or adapted from the Hammitt, et al. instrument. These statements asked respondents their level of agreement with a statement using a 1 – 5 (strongly disagree to strongly agree) scale.

To account for visitors’ non-place related feelings for the natural places portrayed in dioramas, we used the Connectedness to Nature scale developed by Mayer & Frantz (2004). This scale was designed to measure respondents’ levels of emotional connection to the natural world. As with Place Bondedness, the scale consisted of statements with which respondents rated their agreement 1 (strongly disagree) to 5 (strongly agree).

Our instrument also included questions about familiarity with the place depicted in the diorama (e.g., “I feel very familiar with the place shown in this diorama”), prior visitation to that specific place, or to places that look similar to the one portrayed.

The totality of the instrument developed was piloted at the Field Museum. After the pilot study, we included additional questions to address experiences identified during pilot observations and interviews that might influence visitors’ experiences at habitat dioramas and the outcomes visitors took away from their experiences. (We termed these “intensity of experience” and “depth of outcomes” scales respectively.) These scales (rated 1 – 5) included statements such as:

“This diorama brought back memories of my own outdoor experiences.”

“I imagined what it would be like to visit the place shown in this diorama.”

“I learned a lot about this place by looking at the diorama.”

“Viewing this diorama made me feel like I want to visit this place sometime soon.”

Additionally, interview results suggested that respondents’ feelings about places depicted in the dioramas might be influenced by their discomfort with certain aspects of that habitat (insects, snakes, icy landscapes). To account for potential non-place-specific factors that might affect visitors’ responses to dioramas, we developed the Preferences for Outdoor Experiences scale, inspired by two existing scales (Bixler and Floyd’s 1999; Simmons, 1994) Examples of statements (using 1 – 5 ratings as with the scales described above) are:

“I enjoy visiting wild places that have lots of insects and spiders.”

“My favorite outdoor places have broad lawns, formal gardens, and neatly trimmed shrubs.”

The final instrument included seven scales (38 questions) to measure Place Bondedness, aspects and potential outcomes of the diorama experience, and a range of possible contributing factors such as visitation, familiarity, connectedness to nature, and preferences for outdoor experiences. (The instrument appears in Appendix A.)

For a more complete description of the development of the Diorama and Sense of Place instrument, please see the initial study report (Garibay Group, 2013).

OMCA Study Design

Diorama Selection

For the purpose of this research, we focused on three sections of the exhibition where there were five dioramas in close proximity (although not necessarily in view of each other). This included three of the seven California places included in the exhibition: Yosemite, the Tehachapis, and the Coachella Valley. Because feedback from earlier respondents and data collectors at Field Museum and Denver suggested that the survey used at those sites was too long, we chose four of the California dioramas to include in the study (rather than five, as at the earlier sites). As at the museums in the earlier study, we chose a range of natural habitats and tried to achieve a balance between dioramas of places visitors might have first-hand familiarity with (e.g., close to the museum and/or familiar habitat type) and “iconic” places that might be recognizable to visitors even had they not visited (e.g., Yosemite at OMCA, Amazon Rainforest at Field Museum, and Arizona Desert at Denver). The four OMCA dioramas are illustrated and described in Appendix B. We generally refer to these dioramas using shortened versions of their titles, calling them Yosemite, Coast Ranges, Central Valley, and Coachella.

Methodology and Sample

The OMCA study followed the same design and set of instruments as the initial study (Garibay, 2013), with data collected via the Dioramas and Sense of Place instrument serving as the primary source for answering research question. Additionally, we also conducted observations and interviews in the *Natural Sciences* gallery and included two survey questions to summative evaluation questionnaires conducted by Serrell and Associates. Data were collected at the *Natural Sciences* gallery at OMCA during spring and early summer, 2014.

Dioramas and Sense of Place Questionnaire: The Sense of Place instrument described previously was used for this study. Garibay Group trained data collectors at OMCA on data collection for this self-administered instrument and worked with the OMCA team to refine data collection processes. Using random sampling, respondents were recruited on-site in passageways that led to the *Natural Sciences* gallery. Once a visitor crossed a pre-determined imaginary line in this area, they were intercepted and asked to participate in the study. They were then walked back to the Yosemite-Tehachapis-Coachella section of the exhibition, where they explored on their own. They were instructed to look at the four focus dioramas in addition to any other exhibits that interested them. Respondents then completed the Dioramas and Sense of Place survey instrument before moving on to other parts of the museum.

Data were collected across all types of days on which the Museum was open. A total of 250 Dioramas and Sense of Place questionnaires were collected. Of surveys collected, 234 could be used in the analysis (the remaining 16 were either incomplete or were completed by visitors who requested to participate in the study and, therefore, were not part of the random sample).

Observations and interviews: A Garibay Group researcher conducted naturalistic observations and follow-up interviews with visitors to the *Natural Sciences* gallery. The primary purpose of observations and interviews was to understand what respondents were thinking about and feeling as they answered questions on the Dioramas and Sense of Place instrument and triangulate findings. Thus, the interview protocol was developed starting with questions from the Dioramas and Sense of Place questionnaire. Observations included noting behaviors (e.g. search for animals, point, discuss their finds, read labels, talk about the landscape or other issues) which other exhibits besides the dioramas respondents stopped at within that area and what they did at those exhibits. . Qualitative data from the OMCA interviews are included in the results section when they shed light on findings from the quantitative survey study.

As the intent of the qualitative data were to triangulate findings—and given that the initial study helped us determine what the smallest observation sample was that would still yield fruitful information—we conducted observations with 15 purposively sampled groups. Respondents were recruited within the section of the exhibition that includes the dioramas of interest, sometimes before they viewed the dioramas and sometimes afterwards.

Questions included in the summative evaluation surveys: Garibay Group worked with the exhibition’s summative evaluator, Serrell and Associates, to include two questions related to visitors’ connections to place in the summative evaluation instruments. Because these questions were also asked during the front-end evaluation (Garibay, 2008a), we hoped to explore similarities and differences in visitors’ experiences before and after the re-development of the Natural Sciences gallery². The items were phrased as statements, which respondents were asked to rate on a 1-to-4 scale, with 4 = “extremely true for me.” The two statements were:

I was able to personally connect with some of the natural places portrayed in this gallery.

My visit to this gallery today got me to reflect about nature in California.

The questions were included in both parts of the two-part summative evaluation. In the Stay Time study, visitors were free to explore the entire exhibition; in the Personal Connections study, visitors were asked to visit a particular section of the exhibition, one of which was the Yosemite-Tehachapis-Coachella section that included the focus dioramas for our research. Details about the rest of the survey,

² Garibay Group planned to conduct a pre/post study after the renovation to measure the effectiveness of the gallery in helping visitors develop place-based connections to the natural world. Baseline data were collected at three sections of the original hall (Sutter Buttes, Oakland, and Yosemite). Due to changes in the conceptual plan it was not possible to collect post-data in these areas as planned. (The dioramas originally included in the baseline were no longer in the same place-based sections or dioramas that had been clustered were located in different areas of the gallery.) The Sense of Place study conducted at OMCA in lieu of the planned study focused on some of the same research questions. While baseline data were not intended to be interpreted on their own, a summary of these data are included in Appendix G as background information.

recruitment of respondents, and so forth will be included in the full summative evaluation report, which was not available as this report was written.

Characteristics of Sample

As a way of framing the OMCA results when comparing them to the Field Museum and Denver of Nature and Science findings, it is useful to outline the demographic characteristics of the respondents at each site. The total sample for that phase of the project was 633 randomly selected adult respondents, 305 collected at Denver and 328 at the Field Museum (Garibay Groups, 2013).

At all three museums, female respondents outnumbered males 58% to 42%. Some differences in the demographic characteristics of the three samples seemed to be influenced by the presence of a popular traveling exhibition about pirates at the Denver Museum during data collection. For instance, 72% of the Denver respondent groups included children, whereas 71% of the OMCA respondents and 60% of the Field Museum respondents were in groups that did not include children. Perhaps because many of the respondents at Denver were parents with young children, the most frequent group at Denver was the 30s (36%). In contrast, the OMCA sample was rather evenly distributed among the 20s, 30s, and 40s, while the most frequent age range at the Field Museum was 18-29 (38%)

Comparing place of residence among the three museums, the OMCA audience was largely local residents. Almost three-quarters of the respondents gave zip codes within 25 miles of the museum, and only one in ten said they lived out of state. As seen in Table 1, 90% of the respondents in the OMCA study listed a California zip code as their place of residents. Half listed a zip code centered within 10 miles of the museum, and 32% of the total sample listed an Oakland zip code as their place of residence.

Table 1. States of residence of respondents to the OMCA study.

	Count	Percent	Cumulative %
California, 10 mi. or less*	117	51%	51%
California, 11-25 mi.	50	22%	73%
California, 26-50 mi.	23	10%	83%
California, 51-100 mi.	10	4%	87%
California, more 100 mi.	5	2%	90%
Other states in the U.S.A.:	22	10%	99%
Other countries:	2	1%	100%
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Total with residence info:	229	100%	

Note: The California part of the sample is subdivided based on driving distance to OMCA (as calculated using Google Maps).

Perhaps because most of the Field Museum surveys were collected during the summer, only 20% of Field Museum respondents were from the Chicago metropolitan area, and 64% said they were visiting this Chicago tourist destination from out of state. The Denver sample, collected in the spring, included 34% from the Denver metropolitan area, and a total of 85% of these respondents said they were Colorado residents. Probably because it was a largely out-of-state audience, 63% of the Field Museum respondents said they had never seen the *Nature Walk* dioramas before. With its more local audience, only 20% of Denver respondents said they were seeing the *Explore Colorado* dioramas for the first time. In contrast, about half of the even-more-local audience at OMCA said they had never seen the *Natural Sciences* dioramas before. This may be partly because many respondents were recruited at OMCA were at the museum for special events, and, although local, may not have been regular visitors to the museum. It may also be because the OMCA dioramas were in such a radically changed exhibition that they may have looked new even to those who had seen them before.

The OMCA respondent pool was both more diverse in terms of race/ethnicity and more highly educated than the respondent pools at the other two museums. The OMCA sample included 62% who checked the Caucasian box, 20% who checked Asian/Pacific islander, 12% who checked African-American, and 7% Hispanic/Latino. In contrast, race/ethnicity data skewed heavily towards Caucasian at the other two museums (82% at Field Museum and 89% at DMNS). At OMCA 85% of respondents said they had a college degree, and a third had post-doctoral degrees. Two-thirds of the other museum's respondents said they were college graduates and about a quarter of those samples held postgraduate degrees. (Demographic characteristics of the OMCA, Field Museum, and Denver Museum of Nature and Science respondents are detailed in Appendix D.)

The sample size for the questions included in the summative evaluation was 103 respondents for the Stay Time Study and 34 total for the Personal Connections Study (15 of whom had been assigned to the Yosemite-Tehachapis-Coachella section of the exhibition, which was the focus of this study.) The Stay-Time sample included more females than males (63% vs. 37%), more first-time visitors to the *Natural Sciences* gallery than repeat visitors (69% vs. 31%), and fewer groups with children than all-adult groups (32% vs. 68%). Demographic data for the summative Stay-Time study are compared with the front-end exit survey sample in Appendix E. (Note that because the Personal Connections Study, due to its more qualitative nature, had a smaller sample size ($n = 34$ for these items), the data are too small to make any meaningful comparisons with the front-end study and are therefore not included in our analysis).

Observation and interview data included 15 observations, nine of which included follow up interviews. (Interviews for 6 participant groups were not possible either because respondents were too young or because they declined to participate.) These data also included two short interviews with visitors who were not observed in the exhibition.

Analysis

Analysis for data collected via the Dioramas and Sense of Place questionnaire included calculating basic summary statistics and comparing data scores, including mean and median values for each question for each diorama. Scores for the subsets of scales were also calculated for each diorama. These summary statistics were compared, using tables of data and histograms that displayed mean scores for each diorama. To explore the relationships among the variables that might contribute to respondents' Place Bondedness scores, regression analyses were conducted on both answers to individual questions and overall scale scores. Scatter plots of the data were compared visually and R^2 values calculated and compared in tabular form.

For data from questions included in the summative evaluation data, distributions of scores were tabulated and mean values were calculated and compared with data collected during the front-end evaluation. The non-parametric independent-sample Kruskal Wallis Test was used to test the statistical significance of the results.

The observations-interviews data were analyzed using content and thematic analysis, and the findings were compared with similar data collected at the Field Museum and Denver.

Results

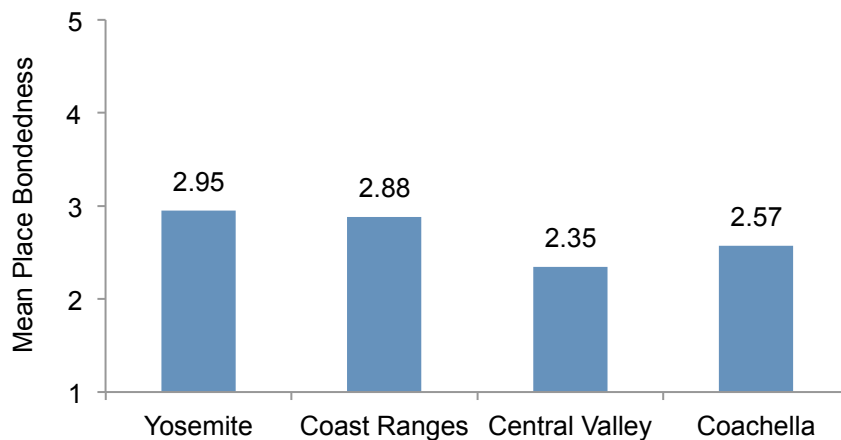
The first section of these results discusses findings from the study at Oakland Museum of California (OMCA). The second section compares these results with findings from the two museums in the earlier study.

Quantifying Sense of Place at OMCA Dioramas

Place Bondedness was measured as the mean score of six statements about respondents' potential connections to the place shown in the diorama. Each statement is rated on a 1-5 scale, with higher ratings indicating higher levels of agreement. The Yosemite Alpine diorama received a mean score of 2.95 and median score of 3.00 (Fig. 1). The Coast Ranges diorama scored slightly lower, with a mean of 2.88 (median 2.83). The Coachella desert diorama scored even lower, on average (mean 2.57, median 2.50), and the Central Valley diorama had the lowest average Place Bondedness scores (mean 2.35, median 2.17).

Subsequent sections of this report discuss factors that may help explain both respondents overall feelings of place bondedness and the differences in their feelings about different dioramas.

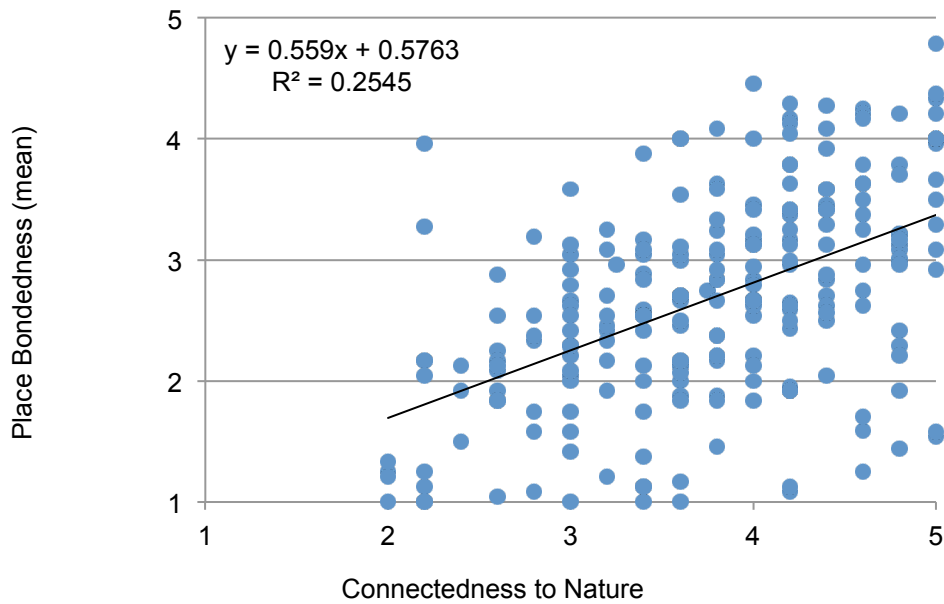
Figure 1. Mean Place Bondedness scores for the four OMCA dioramas included in this study. (n = 234)



Relationship to Connectedness to Nature

The Connectedness to Nature Scale attempts to measure respondents' overall feelings about nature, as opposed to their feelings about specific natural places. Figure 2 plots individual respondent's Connectedness to Nature scores against the mean of their Place Bondedness scores at the four dioramas.

Figure 2. Scatter plot of Place Bondedness (mean of scores on the four dioramas) versus Connectedness to Nature scores for individual OMCA respondents.



Regression analysis indicated that a positive relationship existed between feelings of Place Bondedness and Connectedness to Nature. However, the R^2 value was only 0.25, which means the relationship explains only about 25% of the variance on the data. This suggests other factors must also play important roles in determining individuals' feelings of Place Bondedness for the places depicted in the OMCA dioramas. Additionally, when data were disaggregated by individual dioramas the positive relationship between Connectedness to Nature and Place Bondedness was weak. When Place Bondedness and Connectedness to Nature scores were plotted by individual dioramas, the relationships between these two variables showed positive but weak correlations (see Table 2).

Table 2. Place Bondedness versus Connectedness to Nature Correlations (R^2 values) by Diorama (OMCA)

<u>Independent</u>	<u>Dependent</u>	<u>Yosemite Alpine</u>	<u>Coast Ranges</u>	<u>Central Valley</u>	<u>Coachella</u>
Connectedness	Place Bondedness	0.24	0.19	0.09	0.14

The correlation was strongest for the Yosemite Alpine diorama ($R^2 = 0.24$) and weakest for the Central Valley diorama ($R^2 = 0.09$). In other words, respondents with higher Connectedness to Nature scores tended to express slightly greater levels of Place Bondedness for the Yosemite Alpine setting. On the other hand, respondents with higher levels of Connectedness to Nature had a much weaker tendency to express Place Bondedness for the Central Valley grasslands.

Overall, these data suggest that, in general, respondents who felt stronger connections to the natural world were somewhat more likely to express bondedness with the natural places shown in the dioramas. However, data also indicated that general feelings of connectedness to the natural world seemed to play at best a weak role in determining feelings of bondedness to the particular places portrayed in OMCA's habitat dioramas. Thus, most of the respondents' feelings of Place Bondedness—and especially the differences in their feelings about different diorama places— must be explained by other factors. The rest of the analysis presented here examines those factors.

Place of Residence

In our initial study, we found that three interrelated variables played a large role in respondents' feelings about place: place of residence, prior visitation, and familiarity with the place shown in the diorama (Garibay Group, 2013). We expected to find similar patterns in the OMCA data, but were surprised by some of the results. Table 3 shows that there were small but consistent differences in Place Bondedness scores between those respondents from California and those from other states..

Table 3. Comparisons of Place Bondedness by State of Residence for Individual OMCA Dioramas. (California n = 205, Other States n = 22).

	Yosemite Alpine	Coast Ranges	Central Valley	Coachella
California	2.98	2.94	2.37	2.58
All other states	2.79	2.56	2.23	2.54

Yosemite National Park might be considered an iconic place for all citizens of the United States, and both Californians and non-Californians, on average, recorded their highest Place Bondedness scores for the Yosemite Alpine diorama. The Bay-area-heavy California sample rated the place depicted in the Coast Ranges diorama almost as high as Yosemite, whereas the non-Californians rated it on about the same level as the Coachella desert scene. Both the Coast Ranges and Central Valley are linear geographic features that stretch as far north as the Bay area, although the specific places shown in these dioramas are near the southern reaches of these features. Therefore Oakland-area residents lived fairly close to habitats similar to the ones portrayed in the Coast Ranges and Central Valley dioramas, and that may have led to their high Bondedness with the Coast Ranges scene. Interestingly, Coachella—the location farthest from the museum—received virtually identical Place Bondedness scores from the two groups. Both Californians and non-California residents recorded their lowest levels of Place Bondedness for the Central Valley diorama, although Californians rated it slightly higher than did non-Californians.

What factors might explain these differences, both between California residents and non-Californians, and among the four dioramas? Our earlier study (Garibay Group, 2013) suggested that one must first rule out the influences of Californians' prior visitation to these natural areas and their overall sense of

familiarity with these places. Indeed, Table 4 shows that California-based respondents said they had visited the same or similar natural places more often, and that they felt more familiar with the diorama places. Compared with the differences in visitation and familiarity, the differences in mean Place Bondedness scores between California residents and non-Californians is rather slight.

Table 4. Comparisons of Mean Scores on Three Scales (Averaged Across the Four Dioramas) by State of Residence for Individual OMCA Dioramas. (California n = 205, Other States n = 22).

	Place Bondedness	Visitation³ (median)	Familiarity
California	2.71	2.50	2.95
All other states	2.54	1.75	2.38

In examining factors that might explain this pattern, it was interesting to note that the non-California respondents scored higher on the Connectedness to Nature Scale—3.96 vs. 3.75 for the California residents in the sample. Perhaps this is because many of the Californians recruited for the sample may not have come specifically to see the museum and its natural history exhibits, whereas non-Californians were more apt to have traveled great distances to experience OMCA. The weak positive relationship between Connectedness to Nature and Place Bondedness may have contributed to the relatively small difference in mean Place Bondedness between the two groups.

Prior Visits to and Familiarity with the Places Portrayed in the Dioramas

Since *Visitation and Familiarity with Place* proved to be such important factors in our earlier study (Garibay Group, 2013), we wanted to examine these factors in the OMCA data more closely. Table 5 provides the average scores for each diorama for Visitation and Familiarity with Place.

Table 5. Average scores for Visitation (median) and Familiarity with Place (mean) for Individual OMCA Dioramas. (n = 234).

	Yosemite Alpine	Coast Ranges	Central Valley	Coachella
Visitation (median)	2.5	2	2	2
Familiarity with Place	2.99	2.99	2.96	2.63

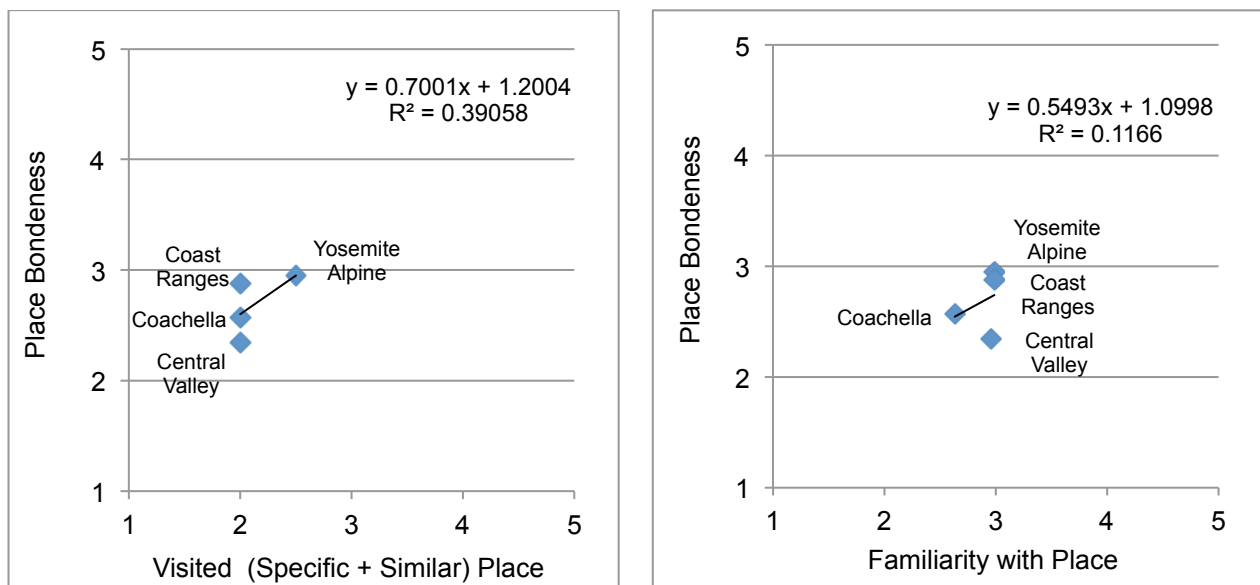
Note: For Visitation, a score of 3 would indicate that half the respondents said they had visited that place at least two or three times. For Familiarity, a score higher than 3 indicates that, on average, respondents agreed that they felt very familiar with that place.

³ Note that the Visitation value we use in this report is the mean score of two items: the Visited specific place and Visited a place that looks similar items on the Dioramas and Sense of Place survey. The reasons for this are reasons described in the earlier report (Garibay Group, 2013).

On average, respondents indicated they had visited Yosemite (or a similar place) more often than any of the other places portrayed in the dioramas and Coachella less often. The Coast Ranges and Central Valley dioramas were in the middle. Respondents, however, said they felt essentially equal levels of familiarity of three of the diorama places: The Yosemite Alpine scene, the mountainous Coast Ranges scene, and the dry grasslands of the Central Valley. Thus factors other than visitation contributed to feelings of familiarity for these places, but we cannot say for certain what these were—perhaps media exposure, looking at museum exhibits, or something else entirely.

Additionally, regression analysis indicated that, at least in the OMCA sample, comparable levels of visitation to a natural area did not necessarily lead to similar Place Bondedness scores—nor did comparable levels of Place Familiarity. The relationship with visitation is illustrated in Figure 3 (left), a plot of mean Place Bondedness vs. median Visitation for the four OMCA dioramas.

Figure 3. Relationships between mean Place Bondedness and median Visitation (left scatter plot) and Familiarity with Place (right plot) for the four dioramas at OMCA.



Three of the dioramas (Coast Ranges, Central Valley, and Coachella) had the same median Visitation scores. Yet the Place Bondedness score for the Central Valley diorama was much lower than Coast Ranges and lower than Coachella. Three OMCA dioramas also had almost identical mean Familiarity scores on the X axis (2.96 for Central Valley and 2.99 for both Yosemite and Coast Ranges), despite their differing Place Bondedness scores. Although the place portrayed in the Coachella diorama had a lower level of Familiarity to OMCA respondents than the other dioramas, on average respondents expressed greater levels of Place Bondedness for the rocky desert scene than for the Central Valley grasslands. As a result, the correlation value for the Figure 3 (right) plot was low ($R^2 = 0.11$).

It's worth noting that during the initial stages of the OMCA study we planned to include only three dioramas (Yosemite, Coast Ranges, and Coachella). We later added the Central Valley grassland diorama to the mix to provide a contrast to the rocky scenes in the other dioramas. Interestingly, if we remove the Central Valley point from the Familiarity-Place Bondedness plot above (Fig. 3 right), the correlation becomes almost perfect ($R^2 = 0.98$), although that's mostly because the Coast Ranges and Yosemite points plot so closely together. However, if we remove Central Valley from the Visitation-Place Bondedness plot (Fig. 3, left), the correlation between median Visitation and Place Bondedness improves only marginally (to $R^2 = 0.41$).

Of course, these averaged scale scores for the dioramas do not reflect the variability in scores on these scales for individual dioramas. Therefore, we also examined scores for each diorama. Place Bondedness-Visitation correlations for two of the OMCA dioramas were higher than the R^2 in Figure 3, and two were lower (Table 6).

Data suggest that OMCA respondents' visits to the Central Valley did not always lead to increased feelings of Place Bondedness with this place. The very low Place Bondedness-Visitation correlations for both the Central Valley and Coachella dioramas implies that OMCA respondents, on average, could feel some level of bondedness to the place shown in these dioramas even if they had never been there, and that even if they had been there before they may not have felt particularly bonded to those places.

Table 6. Place Bondedness versus Visitation and Familiarity of Place Correlations (R^2 values) by Diorama (OMCA)

<i><u>Independent</u></i>	<i><u>Dependent</u></i>	<u>Yosemite Alpine</u>	<u>Coast Ranges</u>	<u>Central Valley</u>	<u>Coachella</u>
Visitation (median)	Place Bondedness	0.39	0.32	0.12	0.05
Familiarity with Place	Place Bondedness	0.52	0.59	0.39	0.31

Looking at the Place Bondedness-Familiarity correlations in Table 6, the higher values indicate that Familiarity with Place had a stronger relationship with Place Bondedness than did Visitation. Both the Yosemite and Coast Ranges R^2 values are greater than 0.5, meaning that respondents' Familiarity scores predict more than half the variation in their Place Bondedness scores for the places portrayed in these dioramas. For the Central Valley grasslands, the correlation value falls into the upper end of the weak range, explaining almost 40% of the variation in Place Bondedness. Those respondents who were more familiar with that place tended to feel more Bonded with it.

How might we reconcile this with the Visitation results? It may be that those who have visited the Central Valley have done so on the highway or with stops to more developed parts of that region, and that this

sort of visitation might contribute little to Familiarity scores. (Some of our open-ended responses from visitors interviewed said they considered driving through an area to be a visit to that place.) Although the correlation for Coachella is the lowest of the four, Familiarity scores predict almost a third of the variation in Place Bondedness. While Familiarity with Place can be influenced by prior visits to that place, other factors can also increase Familiarity (including visits to museum dioramas); it seems those same factors can also increase feelings of connection to that place.

Thus it appears that a complex set of factors contributed to visitors' feelings of Place Bondedness for the places depicted in the OMCA dioramas, and their influences varied depending on which place was depicted. Findings suggest that Bondedness for the sorts of places depicted in habitat dioramas may develop through interactions among several positively related factors: place of residence, visits to the place depicted, visits to places that look similar, and familiarity with place—which can be developed, in part, through indirect experience. However, it's important to note that, based on the Central Valley results, comparable levels of Visitation and Familiarity do not always produce equal levels of Place Bondedness. Some additional factor seemed to negate the effects of Visitation and, to a lesser extent, Familiarity with the Central Valley. We will revisit this issue later in the report.

Intensity of Experience and Depth of Outcomes

As with the earlier Dioramas and Sense of Place Study (Garibay Group, 2013), we included the Intensity of Experience and Depth of Outcomes scales as part of the Sense of Place survey in order to investigate the relationships among respondents' perceptions of their experiences at the dioramas and Place Bondedness. Table 7 shows mean ratings for individual dioramas for each item in the Intensity of Experience Scale.

Table 7. Mean responses to individual items on the Intensity of Experience and Depth of Outcomes scales for the four OMCA dioramas.

<i>Diorama Experience/Outcome Questions</i>	<i>Yosemite Alpine</i>	<i>Coast Ranges</i>	<i>Central Valley</i>	<i>Coachella</i>
<i>Intensity of Experience</i>				
Brought back memories of my outdoor experiences.	3.41	3.25	2.88	2.96
I read most of the labels for this diorama.	3.94	3.84	3.86	3.79
I talked about place with other members of my group.	3.12	3.07	3.17	3.19
I imagined what it would be like to visit the place.	3.83	3.70	3.43	3.80

(table continues)

Table 7. Mean responses to individual items on the Intensity of Experience and Depth of Outcomes scales for the four OMCA dioramas.

Depth of Outcomes				
I learned a lot about this place.	3.53	3.54	3.55	3.55
Made me feel like I want to visit this place.	3.61	3.45	2.78	3.39
Helped me feel more connected to the place.	3.63	3.60	3.19	3.71
One of my favorite dioramas in Natural Sciences.	3.32	3.40	2.86	2.88

Note: This used a 1 to 5 scale, with a score higher than 3 indicating that respondents agree with that statement. Bold = highest score on that item was for that diorama; Italics = lowest score on that item was for that diorama. (Because some respondents did not view all the dioramas, sample size for most items varied from 192 to 225. Because the “talked about place” item only applied to respondents who came with companions, sample size for that question varied from 149 to 178.)

The item on bringing back memories of earlier experiences showed the greatest range in mean scores among the four items. Yosemite—the place with the highest median Visitation score (Table 5)—also scored highest on the item about bringing back memories. However, the other bring-back-memories scores did not directly reflect respondents’ previous visits to these diorama places.

The scores on the items about reading labels were close to equal across the four dioramas. The scores for talking about the dioramas were lower than the scores for reading, although also about equal across the four dioramas. This means that, according to their self-reports, respondents’ decisions to read labels and talk about the dioramas did not vary much with factors like Visitation, Familiarity, and Place Bondedness—which did vary among the four dioramas. We should note that many respondents interviewed said they had read labels to find out more about the animals in the dioramas and had talked about the animals with their companions. Since all the dioramas displayed interesting animals, it’s not surprising that levels of label reading and discussion held fairly constant across the four OMCA dioramas. Although place played a role in many of these animal conversations, it was usually not about the place portrayed in the diorama. Rather respondents discussed other places where they had seen or searched for the animals in the dioramas, such as other parks or their own neighborhoods.

The fourth Intensity of Experience item asked respondents if they had imagined what it would be like to visit that place. On average, most survey respondents said that they had, and it’s interesting that the Coachella diorama inspired this sort of imagining on levels comparable to Yosemite, (the diorama that scored highest on many other items and scales). In other words, the least visited diorama stimulated respondents’ imaginations on levels comparable to the most visited one. When we talked with interview

respondents about their experiences, we heard a wide range of responses about imagining visiting the places depicted in these dioramas. The following quote illustrates the type of responses provided:

I'm an avid hiker, so when I see these dioramas I actually visualize myself in them, because I think about these as destinations to go hiking in. Or sometimes, such as that one right there in the high Sierra, they resemble places where I've actually hiked. So it actually makes me think, for example like in that one, being in the high Sierra where I've hiked and the feeling of being up there, which is of course wonderful.... Maybe that's a little bit odd about wanting to put myself into the dioramas to go hiking, but that's the primary thing that goes through my head when I see these things.

Another respondent said of the Yosemite diorama, "I think it displays the feeling of as close to being there as you can be....I re-live the experiences I've had in Yosemite."

Turning to the items on the Depth of Outcomes Scale (lower half of Table 7), all the mean scores for the "I learned a lot about this place" item were clustered in the 3.53 to 3.55 range. Thus, OMCA respondents said they learned about all the places, regardless of how they scored it on the other variables. (It's important to note that given the research focus, this study did not ask respondents about what specifically they learned and whether they learned it from looking at the diorama itself, reading adjacent labels, or talking with their companions.)

The scores on the item about wanting to visit the place, closely paralleled the Place Bondedness scores. The Yosemite diorama had the highest score for the inspired to visit item. Recall that Yosemite was also the place with the highest Bondedness scores. The Central Valley diorama, which had the lowest Place Bondedness scores, also had the lowest scores for the inspired to visit item. It's not clear to what extent respondents' answers to this item varied based on characteristics of the dioramas as opposed to their memories of previous visits to that place. (The diorama, while appreciated in its own right, may have, for example, reminded some respondents of things they did not appreciate about the actual place portrayed.)

On average, respondents agreed with the statement, "This diorama helped me feel more connected to the place," with agreement being strongest for the Coachella desert scene. In other words, respondents said their increased connectedness was greatest at the diorama that was less visited and less familiar to them than the other three dioramas. This may imply that dioramas may play a role in increasing sense of place for less visited and unfamiliar places.

Finally, on the item that asked about their favorite diorama (bottom of Table 7), more than half the respondents indicated that the Coast Ranges and Yosemite dioramas were among their favorites, with Coast Ranges having the highest score on this item. The Central Valley and Coachella dioramas were

essentially tied for the lowest score on this item; on average fewer than half of respondents agreed that these dioramas were among their favorites. During interviews, respondents gave many reasons for choosing their favorite dioramas, with the animals in the dioramas often influencing respondents' choices as much or more than the scenes themselves. The mountain lion family, in particular, was very popular with our small pool of interview respondents, which may help account for the Coast Ranges diorama's high score on this item. There was also some evidence from observations and interviews that diorama interpretation can influence visitors' choice of favorites, although not always in predictable ways. For instance, one visitor from Spain described the Yosemite diorama as her favorite, because it called other visitors' attention to the issue of climate change:

It's a good diorama to understand the climate change. I was thinking it would be good for young people, if they see that, that image will be in their minds, so maybe they will think about it later....[It was her favorite diorama because] it explains very well the situation of the animals.

Another respondent described this diorama as her least favorite, because thinking about the fate of the Alpine Chipmunks made her sad.

The animals over here, it's too warm for them....It's sad, a horrible thing...[It was my least favorite] just because I was a little bit sadder.

It seems that respondents' reasons for choosing a favorite diorama may be idiosyncratic and even contradictory, and are often independent of their feelings about the place portrayed in that diorama.

Table 8 compares the mean scale scores of Intensity of Experience and Depth of Outcome across the four dioramas. The results indicate that some of the most intense experiences and deepest outcomes occurred at the iconic Yosemite Alpine diorama, whereas the Central Valley grassland diorama scored lowest of the four dioramas, on average. The Coast Ranges and Coachella diorama scored in between the two extremes; their Experiences scores were very close, but the Outcomes score for Coast Ranges was somewhat higher.

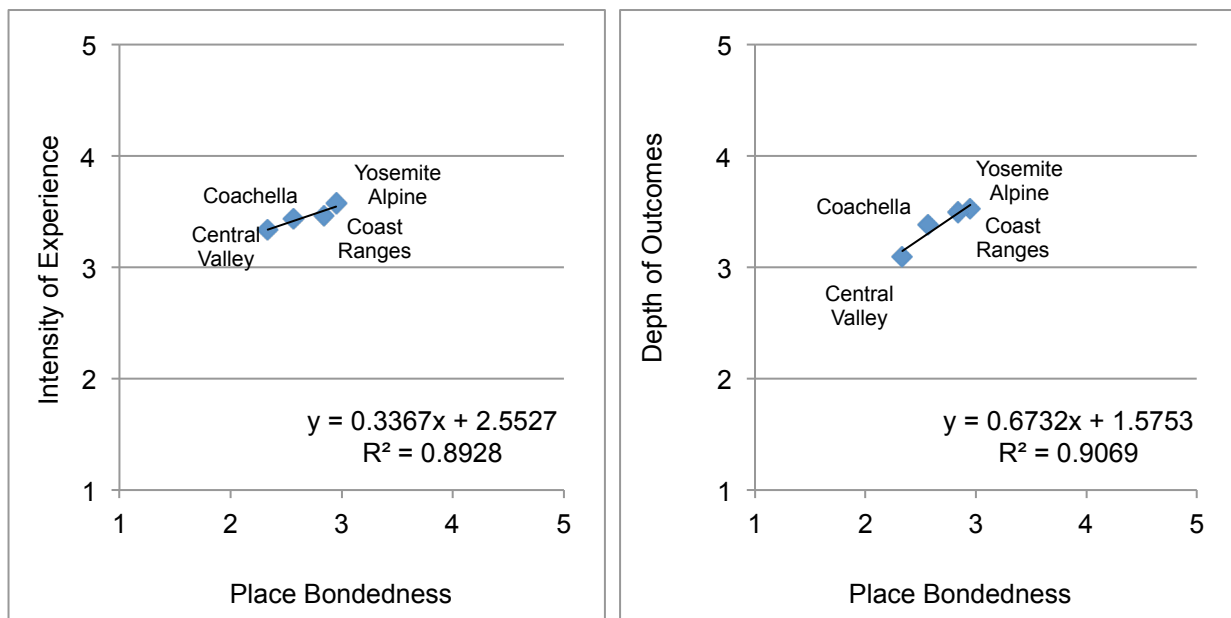
Table 8. Mean scores for the Intensity of Experience and Depth of Outcome scales for the four OMCA dioramas.

<i>Diorama</i>	<u>Experiences</u>	<u>Outcomes</u>
Coachella	3.44	3.38
Yosemite	3.58	3.52
Coast Ranges	3.47	3.50
Central Valley	3.34	3.10
<i>Mean scale score:</i>	3.46	3.38

Note: This used a 1 to 5 scale, with a score higher than 3 indicating that respondents agree with that statement. Bold = highest scale score was for that diorama; Italics = lowest scale score was for that diorama.

Which factors may be influencing the scores on Table 8? Regression analysis of mean Place Bondedness scores with Experience and Outcome scores indicates that mean Intensity of Experience and the Depth of Outcomes scores for the dioramas correlated positively with Place Bondedness score for the dioramas (Figure 4). The strengths of these correlations was very high, R^2 0.89 and 0.90, respectively. Given that both scales correlate highly with Place Bondedness, it is not surprising that they also correlated highly with each other ($R^2 = 0.95$).

Figure 4. Relationships between averaged scores for Place Bondedness and Intensity of Experience (left) and Depth of Outcomes (right) for the four dioramas at OMCA.



However, as seen in Table 9, the relationships of Experience and Outcome scales with other variables investigated in this study were lower. At OMCA, neither Intensity of Experience nor Depth of Outcomes showed strong correlations with Visitation or Familiarity.

It seems to make sense that the Intensity of the Experience at a diorama should contribute to the Depth of Outcomes from that experience. However, we cannot rule out the possibility that some affective factor contributed to both respondents' experiences at the dioramas and outcomes. If this second scenario has validity, then Place Bondedness seems a likely candidate for that affective factor.

Table 9. Intensity of Experience and Depth of Outcomes Correlations for a Range of Variables at OMCA (R² values)

Independent	Dependent	OMCA
Place Bondedness	Intensity of Experience	0.89
Place Bondedness	Depth of Outcomes	0.91
Visitation (median)	Intensity of Experience	0.68
Visitation (median)	Depth of Outcomes	0.25
Familiarity	Intensity of Experience	0.05
Familiarity	Depth of Outcomes	0.01
Intensity of Experience	Depth of Outcomes	0.95

Of course, we cannot untangle the relationships between Place Bondedness, Experience, and Outcomes in ways that would allow us to claim cause and effect. However, it seems significant that these three scales were less related to Visitation and Familiarity (as shown in Table 9). That means that the confounding effects that the Central Valley grasslands had on relationships between Place Bondedness and Visitation and Familiarity were not an issue with the relationships shown in Figure 4.

Comparisons with the Original Natural Sciences Gallery

Responses to the two questions included in the front-end studies for the Natural Sciences Gallery (Garibay Group 2008a and 2008b) were compared to data for these same questions, which were included in the summative evaluation.

The first item asked visitors to rate the statement, “I was able to personally connect with some of the natural places portrayed in this gallery,” using a 1-to-4 scale, where 4 indicated the strongest level of agreement. Table 10 compares the distributions of responses for the front-end study to those from the Stay Time.

Table 10. Comparison of pre-redevelopment (front-end) and post-redevelopment (summative) responses to the item asking visitors to react to a statement about personally connecting to places portrayed in the Natural Sciences gallery.
(Front-end n = 240, Summative n = 103)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Front-end	3%	7%	29%	60%
Summative	0%	6%	25%	69%

Note: 4 indicated the highest level of agreement.

Agreement ratings were higher for this item for the renovated gallery than the original gallery, with 69% of respondents selecting a “4” (highest level of agreement possible) compared to 60%. Comparisons of the pre- and post-sample differences were statistically significant at the 0.03 level using an independent-sample Kruskal Wallis Test.

The second item asked visitors to react to the statement, “My visit to this gallery today got me to reflect about nature in California,” again using a 1-to-4 scale. Table 11 compares the distributions of responses for the two studies, prior to and after redevelopment of the gallery.

Table 11. Comparison of pre-redevelopment (front-end) and post-redevelopment (summative) responses to the item asking visitors to react to a statement about reflecting on nature in California. (Front-end n = 240, Summative n = 103)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Front-end	3%	5%	36%	56%
Summative	0%	2%	21%	77%

Note: 4 indicated the highest level of agreement.

Agreement ratings were higher for this item for the renovated gallery than the original gallery, with 77% of respondents selecting a “4” (highest level of agreement possible) compared to 56%. The comparisons of the pre- and post-sample differences were statistically significant at the 0.002 level using an independent-sample Kruskal Wallis Test.

These results suggest that the redeveloped gallery was somewhat more effective at helping visitors connect to places portrayed in the gallery and at helping them reflect on nature in California. However, as there were some differences between the front-end and summative samples (e.g. higher percentage of first time visitors and few groups with children in the summative sample), these results should be interpreted with some caution.

Also, based on results from the Sense of Place study, described above, it would have been desirable to compare front-end and summative results by respondents' place of residence, since the Sense of Place results showed some important differences along this dimension. Zip code data, however, were not collected for the summative study and, therefore, we were not able to disaggregate the data for this type of comparison.

Comparisons with Field Museum and Denver Museum of Nature and Science

For some perspective on the OMCA results, we also compare results for the three museums involved in the Sense of Place study. These museums differed in many ways; they had different audiences, different dioramas, and different exhibitions surrounding the dioramas. That said, it's interesting to consider the differences in the scale scores (Table 12).

Table 12. Comparing Mean Scale Scores for the Three Museums.

	<u>OMCA</u>	<u>Field Museum</u>	<u>Denver</u>
Visitation (median)	2	2	2.5
Familiarity with Place	2.89	2.90	3.16
Place Bondedness	2.69	2.74	2.97
Connectedness to Nature	3.77	3.50	3.80

Note: Bold = highest scale score was for that museum; Italics = lowest scale score was for that museum. (To aid in interpretation, the highest scores in each comparison are in bold fonts and the lowest scores are in italics.)

Mean Visitation: Respondents in Denver were most apt to have visited the places portrayed in the dioramas at that museum. The lower visitation scores for Field Museum are easiest to explain, since two of their five dioramas portrayed places that were thousands of miles from the museum (Grand Canyon and Amazon rainforest). Distance from the museum could not explain the difference in visitation scores between Oakland and Denver respondents. The farthest diorama place from the Oakland Museum of California (Coachella) was approximately a 500-mile drive, whereas Denver respondents would have had to travel approximately 800 miles from the museum to the Arizona desert scene. It's worth noting, however, that the Oakland respondents had traveled much shorter distances from home to get to the museum. The Denver sample may have included more widely traveled visitors, perhaps visiting both museums and natural places during their travels.

Familiarity and Place Bondedness: Scores were quite similar across the three museums with OMCA and Field Museum scores almost the same for both scales. Two observations might help explain the results. First, although many Field Museum visitors lacked in-person experiences with Grand Canyon and the Amazon, they built their familiarity with these places in other ways, and thus increased their feelings of Place Bondedness. Also, OMCA respondents' in-person experiences with the Central Valley did not always lead to high feelings of Place Bondedness. The higher mean for Familiarity in the Denver sample may be explained by the choice of dioramas in that study, which included several mountain dioramas that seemed iconic for the Denver museum audience. However, the grassland and desert scenes in the Denver sample did not seem to inspire high levels of Place Bondedness among Denver respondents, lowering the mean Place Bondedness scores at that museum.

Connectedness to Nature: Average scores at all three museums were relatively high—well on the “agree” side of the midpoint of the 1-to-5 scale used in this study. Visitors to all three museums seemed to experience the dioramas in light of their relatively positive feelings about the natural world. These feelings of Connectedness to Nature did correlate at least somewhat to feelings of Place Bondedness for many of the places portrayed in habitat dioramas.

Place of Residence: As with the OMCA data, feelings of Place Bondedness at the other two museums also varied according to where respondents lived. For example, in the Field Museum data, mean scores for the Chicago Lakefront diorama were higher for Chicago area residents (3.43) than for all other respondents in the sample (2.37). As with the OMCA data, these differences may be related to how often respondents had visited the Lakefront; Chicago-area residents, on average, said they had visited Chicago’s Lakefront more often (median Visitation 4.5 for Chicago area and 2.0 for all others). In the Denver study, Colorado residents were more likely to have visited Loveland Pass (median Visitation 4) and expressed somewhat greater Place Bondedness (3.49) for this iconic Colorado location than did the non-Colorado resident sample (median Visitation 3, Bondedness 3.23).

Comparing the strength of the relationships of key variables with Place Bondedness, correlations of Place Bondedness vs. averaged Visitation for the five-diorama samples at Field Museum and Denver showed strong relationships between bondedness and visitation ($R^2 = 0.84$ and $R^2 = 0.89$ respectively for Field Museum and Denver). As noted above, the OMCA sample defied that trend, producing a relatively weak positive correlation ($R^2 = 0.39$), apparently because of the selection of dioramas in the study. In the Field Museum and Denver samples, Familiarity with Place was more highly correlated than Visitation. Averaging across the five dioramas studied at each of these museums, Familiarity with Place was highly correlated with Place Bondedness, with an astonishing R^2 of 0.97 for the Denver dioramas and R^2 of 0.89 for Field Museum. On average, visitors expressed stronger feelings of Bondedness for places that felt more familiar to them, even if those places were, like the Grand Canyon, and Amazon Rainforest, far from home and rarely—if ever—visited. Perhaps that was, in part, because it is possible, through television, museum visits, or other media, to “get to know” a place without actually visiting it (Garibay Group, 2013). Again, the OMCA data differed, producing a weak positive correlation between Familiarity with Place and Place Bondedness ($R^2 = .12$). In both cases the Central Valley grasslands diorama did not fit the trend defined by the three other dioramas.

Intensity of Experience and Depth of Outcomes: Comparing the OMCA scores with those at the other museums, we noted several similarities and differences (Appendix F). For instance, respondents at all three museums indicated that their diorama experiences made them feel like they wanted to visit the place depicted in the diorama. Average ratings were highest at OMCA (3.43), compared with 3.41 at Denver and 3.13 at the Field Museum. Two of the Field Museum places were thousands of miles from

that museum, probably accounting for the lower scores there. Note that the averaged learning-about-place score at OMCA (3.54) was higher than both Denver (3.36) and the Field Museum (3.16). However, it's not clear how much those differences could be accounted for by differences in the audiences (e.g., many more adults visiting with children at Denver) or by qualities of the exhibitions (e.g., Field Museum interpretation was not focused as much on place). It's also interesting that OMCA respondents reported higher levels of agreement to the statement, "Viewing this diorama helped me feel more connected to the place it portrays." OMCA respondents rated this question 3.42 on average across the dioramas at that museum, compared with 3.29 at Denver and 3.13 at Field Museum. It is difficult to determine the reasons for these differences, but it may be because OMCA visitors were viewing a very place-focused exhibition, (and most of them were not distracted by children). Finally, there was very little difference among the three museums for one of the diorama experience items: respondents at all three museums agreed with the statement, "I imagined what it would be like to visit the place shown in this diorama," to similar extents (3.41 at OMCA, 3.43 at Denver, and 3.37 at Field Museum).

As shown in Table 13, the Field Museum and Denver Museum of Nature and Science samples showed very different relationships among the five variables on this table. In the previous study, (Garibay Group, 2013), the researchers noted that it seemed likely that the Denver sample contained "a robust feedback loop between Visitation and Place Bondedness. Many places depicted in the dioramas are within a day's drive for many respondents in our sample; 86% of them live in Colorado." Based in part on the high levels of visitation in the Denver sample, we hypothesized that respondents who felt bonded to the real places depicted in the dioramas were more likely to have visited those places, which in turn may have deepened feelings of both Familiarity and Place Bondedness. The sense of place literature provides some support for this claim (Hammit et al., 2009). We also suggested that these relationships might be taken a step further in diorama halls, "with the interrelated variables Visitation, Familiarity, and Place Bondedness exerting positive influences on visitors' experiences and outcomes at dioramas."

Table 13. Intensity of Experience and Depth of Outcomes Correlations for the Three Museums (R² values)

Independent	Dependent	OMCA	Field Museum	Denver
Place Bondedness	Intensity of Experience	0.89	0.81	0.95
Place Bondedness	Depth of Outcomes	0.91	0.03	0.85
Visitation (averaged)	Intensity of Experience	0.68	0.64	0.94
Visitation (averaged)	Depth of Outcomes	0.25	0.05 (-)	0.77
Familiarity	Intensity of Experience	0.05	0.43	0.91
Familiarity	Depth of Outcomes	0.01	0.15 (-)	0.73

In contrast, the Field Museum dioramas were a mix of “regionally accessible places (in Illinois and Michigan) and places a thousand miles away or more (Grand Canyon and the Amazon) that were shown...to be iconic locales among Field Museum visitors.” We hypothesized that the Visitation-Familiarity-Place Bondedness interrelationships as seen in the Denver sample were confounded at Field Museum by the two iconic dioramas of distant places. “Visitors were apparently attracted to and intrigued by these iconic places despite the fact that they had never been there and were less familiar with them than with Midwestern habitats....Field Museum visitors were more apt to report that, based on their experiences with the Amazon and Grand Canyon dioramas, they learned a lot, wanted to visit and felt more connected to these distant places, and were more apt to say that diorama was one of their favorites” (Garibay Group, 2013).

Comparing the OMCA data with the results from the other two museums, it's clear that the OMCA results added an additional twist to this story. As noted earlier, OMCA respondents' previous visits to and familiarity with the Central Valley grasslands did not necessarily lead to high levels of Place Bondedness. For whatever reason, OMCA respondents felt lower levels of connectedness to this place than would have been predicted if the sorts of Visitation-Place Bondedness and Familiarity-Place Bondedness relations that we found in the earlier study (especially at Denver) had held. However, these data suggest that OMCA respondents' experiences and outcomes at these dioramas did have a strong positive relationship to their feelings of Bondedness to the places portrayed in the dioramas. It seems that visitors who felt little connection to the Central Valley reported less intense Experiences at that diorama and lower Outcome scores, on average. Likely due to the confounding effects of the Central Valley diorama, Visitation showed weak to moderate relationships with how OMCA visitors experienced the dioramas and with what they took away from those experiences. Additionally, the relationships of these variables to Familiarity were extremely weak.

Discussion and Conclusions

This research continued our investigation into the role of Sense of Place in visitors' experiences at habitat dioramas. As with the earlier research at Denver and the Field Museum, OMCA respondents expressed feelings of Place Bondedness for the places depicted in the dioramas in this study. Their feelings varied across the range of dioramas, with mountainous scenes eliciting stronger feelings of bondedness than a rocky desert scene or a grassland scene from the Central Valley. As in the earlier study, these results suggested that Bondedness for the sorts of places depicted in habitat dioramas develops through interactions between several positively related factors, including visits to the specific place depicted or places that seem similar and overall familiarity with the places portrayed in the dioramas.

However, the OMCA findings have added a new factor to the list of influences on Place Bondedness, one that can work in a negative as well as a positive direction. For unclear reasons, something about the Central Valley diorama seemed to limit respondents' feelings for this place, previous visits to and familiarity with the area notwithstanding. This finding is supported by this diorama receiving the lowest scores on the Intensity of Experience and Depth of Outcome scales. OMCA respondents said this was their least favorite diorama. The results for the Central Valley diorama suggested that, for some natural habitats, familiarity and even repeated visits do not always lead to greater feelings of Place Bondedness, and that these effects could not be counteracted by their brief exposure to the OMCA's elk diorama. However, based on the available data, we cannot determine whether it was something about the diorama—perhaps its relatively flat topography, sparse and plain vegetation, or signs of human activity—or some aspect of respondents' first-hand experiences in the Central Valley that limited their feelings of connection to that place. We hypothesize that this factor may have to do with something of an affective nature—a factor that might be termed Aesthetic Preferences, Likeability, or something similar—which might be at play. Nonetheless, respondents said they read and learned about the Central Valley diorama at levels comparable to the other three dioramas in this study, indicating that the lack of connectedness did not necessarily lead to an ineffective experience. While these results raise interesting questions about what this factor might be, the data do not allow us to draw specific implications for exhibit development and design.

Despite the questions this additional factor raised, there was evidence in the OMCA results that both Visitation and Familiarity with Place may, to some extent, be influenced by experiences at natural history exhibitions. Respondents in our sample indicated that their diorama experiences made them feel that they wanted to visit many of the places depicted in the dioramas. Also, OMCA respondents' scores for the item on learning about diorama places fell within a very narrow range relatively high on the agreement scale; in other words, respondents said they learned about all the places, regardless of how connected they felt to them. (Given the nature of this study, of course, it is not possible to determine which aspects of the diorama experience stimulated learning and the desire to visit the places portrayed.)

Finally, findings from the summative evaluation suggest that the redeveloped *Natural Science* gallery may be more effective than the original exhibition at encouraging two place-related outcomes. We found a statistically significant increase in respondents' connectedness to the places portrayed in the dioramas. For a related item on the Dioramas and Sense of Place survey, respondents to this survey attributed increased connections to place to their experiences at the dioramas. We also found a statistically significant increase in visitors' self-reported reflection about the nature found in California. That change might be attributed to a wide varieties of exhibit techniques used stimulate these sorts of reflections in the renovated gallery.

Returning to the research questions posed at the beginning this report, the overall study has revealed some of the roles that Sense of Place plays in visitors' experiences with habitat dioramas. We can also provide at least partial answers to the sub-questions under the larger research question:

- Many visitors did feel connections to the places they view in diorama halls, and the extent of those feelings varied in ways that seem to be somewhat predictable.
- There is evidence that both the experiences and the outcomes of visitors' diorama experiences were related to their feelings about the places those dioramas portray.
- A range of factors contributed to (and may be in turn affected by) visitors' feelings of place bondedness for the places portrayed in dioramas. These include previous visits to the place portrayed or to places that seem similar to it; feelings of familiarity with the place; aesthetic and other affective reactions to the place, or to the way it's portrayed in the diorama; and overall connectedness to nature (in a non-place-specific sense).
- We also found evidence that museums can initiate or reinforce visitors' feelings of place bondedness, by encouraging visitation and building familiarity.

This exploratory study at three museum diorama halls has laid the initial groundwork for investigating whether dioramas can foster a Sense of Place. We found that the many factors that contribute to visitors' feelings of Place Bondedness seem intertwined and perhaps subject to positive feedback loops. We also found that the current Dioramas and Sense of Place scale does not account for all the factors at play in developing Sense of Place. Based on the OMCA study, there seem to be important psychological factors, perhaps related to aesthetic preferences or likeability of a place, which we were not directly taking into account. We also hypothesize that there may be other emotional or psychological factors at play—some that may be shared among visitors (for example, responses to the majesty of the Grand Canyon)—and others that are more personal and specific to an individual (such as connections to relatives or friends who live near a specific place portrayed). These factors may play an indirect influence in those dimensions we do measure (e.g., by inspiring Visitation and supporting Familiarity with a place), but the current Dioramas and Sense of Place instrument does not directly measure them. Continuing studies may help us shed more light on ways in which natural history museums and their habitat dioramas can develop visitors' positive feelings for natural places.

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Appendix A: Dioramas and Sense of Place Instrument

Place Bondedness

These 20 questions were asked about each target diorama. Photo and place name was changed accordingly for each diorama. Each diorama and accompanying questions appeared on separate pages.



Natural Sciences Diorama: Coachella Valley, California

Number: ____

Please circle your answers

1. Do you recall seeing this diorama during your visit?		Yes	No			
2.	How often have you visited the specific place shown in this diorama?	Never	1 time	2-3 times	4-5 times	More than 5 times
3.	How often have you visited a place that looks similar to this one?	Never	1 time	2-3 times	4-5 times	More than 5 times
4.	How often have you visited this place (or a similar one) with people who toured the <i>Natural Sciences Gallery</i> with you today?	Never	1 time	2-3 times	4-5 times	More than 5 times
		Strongly Disagree				Strongly Agree
5.	I feel very familiar with the place shown in this diorama.	1	2	3	4	5
6.	I feel very familiar with the animals and plants shown in this diorama.	1	2	3	4	5
7.	I feel connected to the place shown in this diorama.	1	2	3	4	5
8.	I feel like I belong at this place.	1	2	3	4	5
9.	This place is very special to me.	1	2	3	4	5
10.	If I visited this place, I would feel like I was part of it.	1	2	3	4	5
11.	I identify strongly with this place.	1	2	3	4	5
12.	I am very attached to this place.	1	2	3	4	5
13.	This diorama brought back memories of my own outdoor experiences.	1	2	3	4	5
14.	I read most of the labels for this diorama.	1	2	3	4	5
15.	I talked about the place shown in this diorama with other members of my group.	1	2	3	4	5
16.	I imagined what it would be like to visit the place shown in this diorama.	1	2	3	4	5
17.	I learned a lot about this place by looking at the diorama.	1	2	3	4	5
18.	Viewing this diorama made me feel like I want to visit this place sometime soon.	1	2	3	4	5
19.	Viewing this diorama helped me feel more connected to the place it portrays.	1	2	3	4	5
20.	This is one of my favorite dioramas in the <i>Natural Sciences</i> exhibit.	1	2	3	4	5

Appendix A: Dioramas and Sense of Place Instrument

Connectedness to Nature and Preferences for Outdoor Experiences

Questions 1-5 comprise Connectedness to Nature scale. Questions 6 to 13 comprise Preferences in Outdoor Experiences scale. (These set of questions were asked only once of each respondent.)

Please circle your answers, below

		Strongly Disagree				Strongly Agree
1.	I often feel a sense of oneness with the natural world around me.	1	2	3	4	5
2.	I think of the natural world as a community to which I belong.	1	2	3	4	5
3.	I often feel disconnected from nature.	1	2	3	4	5
4.	I often feel a kinship with animals and plants.	1	2	3	4	5
5.	I often feel that I am only a small part of the natural world around me, and that I am no more important than the grass on the ground and the birds in the trees.	1	2	3	4	5
6.	I enjoy visiting wild places that have lots of insects and spiders.	1	2	3	4	5
7.	I try to avoid steep hills and the edges of high cliffs.	1	2	3	4	5
8.	When the temperature is below zero, I'd rather stay indoors.	1	2	3	4	5
9.	I don't mind getting my shoes wet and muddy.	1	2	3	4	5
10.	My favorite outdoor places have broad lawns, formal gardens, and neatly trimmed shrubs.	1	2	3	4	5
11.	I try to avoid places where snakes are common.	1	2	3	4	5
12.	I would rather walk on a cleared path than hike through tall grass and weeds.	1	2	3	4	5
13.	I don't mind being active outdoors in hot and humid weather.	1	2	3	4	5

Appendix A: Dioramas and Sense of Place Instrument

Demographic Questions

These questions were asked once for each respondent.

Please share some additional information.

We want to include a broad and diverse range of visitors as participants in this survey. The following questions help us know how well we are meeting that goal.

1. How many people came with you to the museum today? _____
2. How many children are in your group? _____
3. How many times have you visited the *Natural Sciences* dioramas before today?
 - never once twice three or four times five times or more
4. What is your age?
 - 18 to 29 30 to 39 40 to 49 50 to 59 60 to 69 70 or older
5. What is your zip code (for U.S. residents)? [If from outside the U.S., please indicate the country you live in.] _____
6. What is your gender? Male Female
7. What is your occupation? _____
8. What is your race/ethnic origin? (check all that apply)
 - African-American
 - Asian/Pacific Islander
 - Caucasian
 - Hispanic/Latino
 - Native American
 - Other: _____
9. What is highest level of education you have completed? (check one)
 - Less than high school graduate
 - High school graduate
 - Trade or career school graduate
 - Some college education
 - College graduate
 - Some postgraduate education
 - Postgraduate degree

Appendix B: California Natural Sciences Dioramas Included in the Study

Diorama 1. Yosemite Alpine Peaks



Description of the diorama and its interpretation: A brown National Park Service-like sign to the right of this diorama labeled it as “ALPINE PEAKS ELEVATION 9,000 FT +.” The rocky tundra foreground overlooks a view of snowy mountain peaks of the Sierra Nevada range. Small, cushion-like tundra wildflowers grow between the granite boulders. The animals in this diorama are mostly small, including Yellow-bellied Marmot, Gray-crowned Rosy Finches, and Alpine Chipmunks. These creatures are identified and briefly described in the label interpretation. However, the major focus of the interpretation—both immediately adjacent to the diorama and on a nearby wall—is the effects of climate change on alpine habitats. One label states, “As the climate warms, species adapted to life on Yosemite’s heights have no place to go.”

Why this diorama was chosen for the study: We anticipated that Yosemite National Park would be an iconic place for both Oakland residents and those who live far from the museum. The diorama’s alpine habitat is similar to the habitat shown in Denver’s Loveland Pass diorama. However, Denver museum visitors probably had more first-hand experience with that place than Oakland Museum visitors do to Yosemite’s alpine peaks, since a major interstate highway bisects Loveland Pass.

Diorama 2. Tehachapis Coast Ranges



Description of the diorama and its interpretation: On a rocky ledge, a mother mountain lion and her cubs defend their mule deer prey from a raven. The scene overlooks tree-covered mountains of the far southern reaches of California’s Coast Ranges. (The southern section of the Coast Ranges reaches all the way north to the Oakland area.) Vegetation on the ledge includes sparse grasses, wildflowers, and brush between the boulders. In addition to the mammals and bird, the diorama includes a small horse fly on the mother lion’s shoulder. The label immediately to the right of the diorama focuses on the Coast Ranges animals: “The Coast Ranges—still largely undeveloped—give mountain lions, deer, and other large animals the room they need to roam.” There is also brief discussion of how the chaparral’s mix of plants supports the animal community. Farther to the right is larger label discussing another Coast Ranges inhabitant, the California Condor.

Why this diorama was chosen for the study: Although the scene depicted in this diorama is hundreds of miles south of Oakland, there are similar mountains (the northward extension of the Coast Ranges) in the Bay Area. Therefore, we expected the place portrayed in the Coast Ranges diorama would seem familiar to respondents who had hiked and explored—or perhaps even driven through—the Bay Area.

Diorama 3. Tehachapis Central Valley



Description of the diorama and its interpretation: This diorama portrays three tule elk, an endangered subspecies that today lives only in California's Central Valley. Their habitat includes bunched grasses and sparse wildflowers, with patches of small woody plants in the far background. A fence stretches off into the distance on the left, protecting this managed elk herd. The interpretation on the rail labels discusses the history of tule elk, from their pre-settlement range throughout a wildlife-rich California landscape, through their population decline due to commercial hunting and agriculture, to the conservation efforts to manage and protect tule elk.

Why this diorama was chosen for the study: We included this diorama so we would have a contrast to the rocky, topographically varied scenes in the other three dioramas. Also, the Central Valley stretches well into northern California, and parts of it are within easy driving distance of the Bay Area, so OMCA visitors might have gained experience with the widely scattered remnants of its original grassland habitats even if they never traveled as far south as Tule Elk State Natural Reserve. The dry grassland scene was also similar to the Pawnee Grasslands diorama at Denver Museum of Nature and Science.

Diorama 4. Coachella Valley



Description of the diorama and its interpretation: An endangered Peninsular Bighorn Sheep stands on a rocky ledge above the desert floor, with desert vegetation growing between the boulders. Visitors can also search for a rattlesnake and small lizard among the rocks. The rail labels identify and briefly discuss the bighorn, reptiles, and one plant species. These labels also discuss how some animals, like the bighorn, can only be found on the rocky slopes depicted here, and how fragmentation and loss of desert habitat to human development are a threat to the Peninsular Bighorn Sheep's survival

Why this diorama was chosen for the study: The desert habitat contrasts with the grassland, chaparral, and alpine habitats of the other dioramas. This diorama depicts the place that's farthest from the Oakland area (about 500 miles away) and it shows a habitat not found near Oakland. Thus we expected that this scene was not as familiar to Bay Area residents as the other dioramas. The Denver Museum also has a desert diorama, depicting an Arizona desert.

Appendix C. Data Collection Counts and Timing (Comparing the Three Museums)

Table 14: Data Collection Counts and Timing

	OMCA	Field	Denver
Survey count:	234 ⁴	328	305
Refusals:	45%	67%	64%
Timing	June 2014	Winter-Summer 2011	Spring 2011

⁴ 250 surveys were collected by OMCA evaluation staff across all types of open days. 234 of these surveys could be included in the analysis.

Appendix D. Respondent Demographics (Comparing the Three Museums)

Table 15. Gender

	OMCA	Field	Denver
Male	42%	42%	42%
Female	58%	58%	58%

Table 16. Age

	OMCA	Field	Denver
18-29	23%	38%	20%
30-39	25%	21%	36%
40-49	20%	23%	25%
50-59	13%	15%	13%
60-69	10%	2%	6%
70 or older	9%	1%	1%

Table 17. Children in group

	OMCA	Field	Denver
0	71%	60%	28%
1	16%	18%	21%
> 1	13%	22%	51%

Table 18. Place of residence (For the purposes of this table, “Metro area” for Oakland was defined as 25 miles or less from the museum)

	OMCA	Field	Denver
Metro area	73%*	20%	34%
Same state	16%	5%	52%
Other states	10%	64%	14%
Other countries	1%	12%	0.33%

Table 19. Visited these dioramas before

	OMCA	Field	Denver
Never	50%	63%	20%
Once	18%	14%	12%
More	32%	23%	68%
Never	50%	63%	20%

Appendix E. Respondent Demographics: Comparing Front-end and Summative Samples

There were 240 surveys collected for the front-end study, and 103 surveys for the summative stay-time study. Note that sample size for individual questions may vary from that, because some respondents skipped one or more questions.

Table 20. Gender

	Front-end	Summative (stay-time)
Male	44%	37%
Female	56%	63%

Table 21. Visited *Natural Sciences* galley before

	Front-end	Summative (stay-time)
First time	52%	69%
Repeat	48%	31%

Table 22. Children in group

	Front-end	Summative (stay-time)
Yes	51%	32%
No	49%	68%

Appendix F. Diorama Experience and Outcome Scores for Each Diorama

Table 23. Comparisons among the three museum diorama experience/outcome questions

	<u>OMCA</u>	<u>Field Museum</u>	<u>Denver</u>
Intensity of Experience			
Brought back memories of my outdoor experiences.	3.13	2.97	3.42
I read most of the labels for this diorama.	3.86	3.44	3.42
I talked about place with other members of my group.	3.50	3.33	3.25
I imagined what it would be like to visit the place.	3.41	3.40	3.49
Mean Scale Score	3.46	3.28	3.39
Depth of Outcomes			
I learned a lot about this place.	3.54	3.17	3.43
Made me feel like I want to visit this place.	3.43	3.13	3.47
Helped me feel more connected to the place.	3.42	3.15	3.39
One of my favorite dioramas in Natural Sciences.	3.32	2.88	3.03
Mean Scale Score	3.38	3.08	3.33

Note: Bold = highest for that question. Italics = lowest for that question

Appendix G. Original Natural Sciences Gallery: Baseline Data Summary

Diorama 1. Sutter Buttes

A total of 31 groups were observed and interviewed between the dates of June 14, 2009 and August 23, 2009.

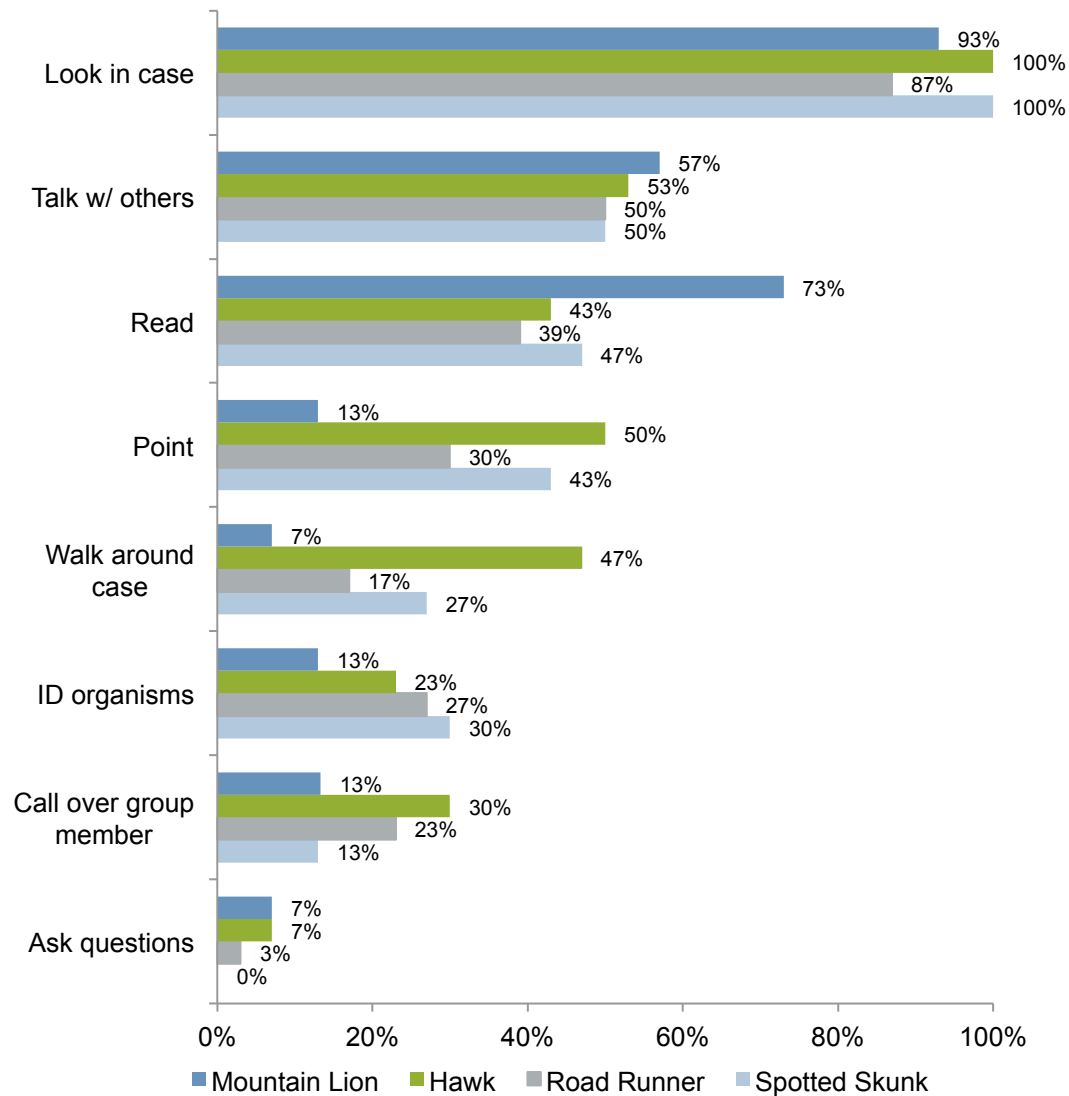
Demographics

- The majority of interviewed families (63%) were adult-only groups. The rest included adults and kids (23%) or adults and teens (13%).
- The majority of families (67%) consisted of 2 members. The average group size was 3.
- The vast majority of respondents (87%) were native English speakers. A small percent (13%) spoke English fluently but reported that it was their second language.
- There was an even distribution between male and female respondents, with 15 and 16 men and women respectively.
- While interviewees represented a wide range of age groups, respondents were slightly younger, with 29% between ages 18-29 and 19% in their 30s.
- Respondents were primarily of Caucasian (61%) ethnicity. In addition, 16% were African-American, 16% Hispanic/Latino, 3% were Native American, and 3% were Asian/Pacific Islander.
- Nearly half (47%) of the interviewed family members were first-time visitors to OMCA.
- Approximately a quarter of respondents (24%) were members of the OMCA.
- About one third of the interviewees (38%) were first-time visitors to the gallery.
- The vast majority of visitors (83%) said that they had experience, background in, or interest in nature. When asked of their specific type of interest/experience, they primarily talked about going on camping, hiking, and backpacking trips or just enjoying nature/being outdoors. Additional experiences that were mentioned included: bird watching, running, and weather.

Behaviors

- Respondents typically focused their initial attention on the Spotted Skunk case, with 55% of respondents stopping there first. After, visitors typically moved to the Roadrunner, followed by the Hawk, then finally the Mountain lion case.
- Visitors to the Hawk case exhibited the widest variety of behaviors compared to any of the other 3 cases. For example, far more respondents talked with other group members (53%), pointed things out (50%), walked around the case (47%), bent down to look closer (20%), or called someone over (27%) at the Hawk exhibit than any other.
- Visitors at the Mountain lion case exhibited the lowest variety of behaviors, but more people were observed reading text there (73%) than at any other case.
- Asking questions was the least common behavior observed at any of the cases.

Figure 5. Behaviors observed at Sutter Buttes Dioramas



Main theme

When asked to identify the main theme or idea that the four exhibits were trying to convey, a large percent of respondents saw not one primary theme but rather two separate ones. About 27% of the respondents discussed the idea of the “Food chain” but mostly referring to the Mountain Lion case. At the same time, 33% of the respondents elaborated on the idea of “Life cycles” (regeneration and continuity) represented primarily by the other cases (Hawk, Roadrunner and Skunk).

Nevertheless, more than a quarter of the respondents (30%) saw an overarching idea uniting all four cases as one depicting animals in their natural habitat. There was almost no mention specifically of the Chaparral in Sacramento River Valley. Additional themes included California Wildlife, Animal/habitat diversity, Lower woodland animals, and nature.

Table 24. Respondents’ perception of the main theme

	N*	Percent
Animals in their natural habitat	9	30%
Life cycles (Regeneration, continuity)	10	33%
Food chain	8	27%
CA wildlife	4	13%
Animal/habitat diversity	2	7%
Complexity of an ecosystem	1	3%
Lower woodland animals	1	3%
Nature	1	3%

*Note: Respondents who replied N/A or none were omitted from data

Depiction of Time In Exhibits

- Some two-thirds of respondents (67%) agreed that the exhibits showed time in some way. When asked to elaborate, about 39% of the respondents saw the idea of time primarily expressed through the 3 cases (Hawk, Roadrunner and Skunk), which illustrated the 3 stages of burn cycle: from normal to burnt to regenerated. They perceived those as representing the idea of change through the passage of time.
- At the same time, 18% of the visitors saw the scenes depicted in the dioramas as illustrating a moment in the past. There were two reasons for that: a) the cases looked outdated (and were created decades ago) and b) most respondents felt that it was almost impossible to see these scenes in a present-day real natural environment, since animal habitats have changed dramatically over the years.

Table 25. Respondents’ perceptions of time

	N*	Percent
Shows passage of time (burn cycle)	11	37%
Represents animal scenes from the past	5	17%
Represents a certain moment in time	1	3%
Related to environmental issues (pollution)	1	3%

*Note: Respondents who replied N/A or none were omitted from data

Connections

- For the majority of respondents (70%), the exhibits were reminiscent of a particular place. Some named specific places and others gave more general responses, such as “Southern California” or “Africa.” Most respondents connected mentally those places to events from their childhood—hiking and camping trips or familiar areas near their homes.
- When asked if they felt a connection to a particular place as a result of seeing the exhibits, 40% of the respondents reported feeling that connection. The primary reasons for that were the childhood memories, or hiking/camping trips with friends and families, that were personal to them.

- Seeing the animals in their natural habitat also seemed to facilitate that connection and speak to respondents on an even deeper emotional level. Some respondents talked about the their connections to the animals in the scene as a vehicle to help them connect to the depicted place as well. [Add a bullet?] When asked if the exhibits sparked any emotions for them, 63% of respondents associated their feelings with the actual animals rather than the physical places. For example, most visitors (31%) reported feeling sad seeing dead animals or learning about animals losing their habitats. Others (12%) enjoyed seeing all the different species of animals. Additionally, some respondents (15%) felt nostalgic for their childhood or home, which they associated with pleasant memories.

Table 26. Respondents’ emotional reactions

	N	Percent
Sadness about animals (seeing dead animals (prey), animals losing habitat)	8	31%
Enjoyment looking at animals	3	12%
Nostalgia for childhood or home (pleasant memories	4	15%
Fear of the ML	1	4%
Frustration	1	4%
Peace	1	4%
Hope (at the idea of renewal)	1	4%
N/A	7	27%

Respondents were also asked a set of questions referring to the extent to which knowing the place depicted in the exhibits affected their emotional connections with that place or their experience with the exhibits.

- When asked specifically, the vast majority (93%)of respondents were not able to recognize the scenes in the exhibits as representative of Chaparral in Sacramento River Valley.
- A large percent of them (83%) also said that they had not visited this area before.
- More than half (57%) stated that knowing these exhibits depict the Chaparral in Sacramento River Valley made them more connected to the place. Since the majority of them had not visited the place by themselves, feeling a connection based only on learning about the place was rather challenging. Respondents said, however, that identifying the place a) inspired curiosity to go and visit it, b) made them more interested and wanting to learn more, c) increased their awareness of habitat preservation, and d) made them realize that it is not far from their home.
- In order to fully understand whether visitors form connections with the natural places based on a) the exhibits themselves or b) knowing the places they represented, participants were asked a set of questions about this issue. Neither factor was dominant. Nearly half the respondents (43%) thought the exhibits themselves facilitated a strong connection to the natural places depicted. They enjoyed feeling immersed in nature, observing the wildlife and the details of the dioramas, regardless of the place they represented. They also liked “the big picture” discussion about life cycle and ecosystems. Those that preferred knowing the location (48%) explained that this information deepened their connection to the place because they realized it was so close to their home and they had an opportunity to actually visit it. Others just liked having this specific type of information as a reference point in their mind while viewing the exhibit. Just one group thought both factors were important.

Diorama 2. Oakland

A total of 31 groups were observed and interviewed between the dates of June 14, 2009 and August 23, 2009.

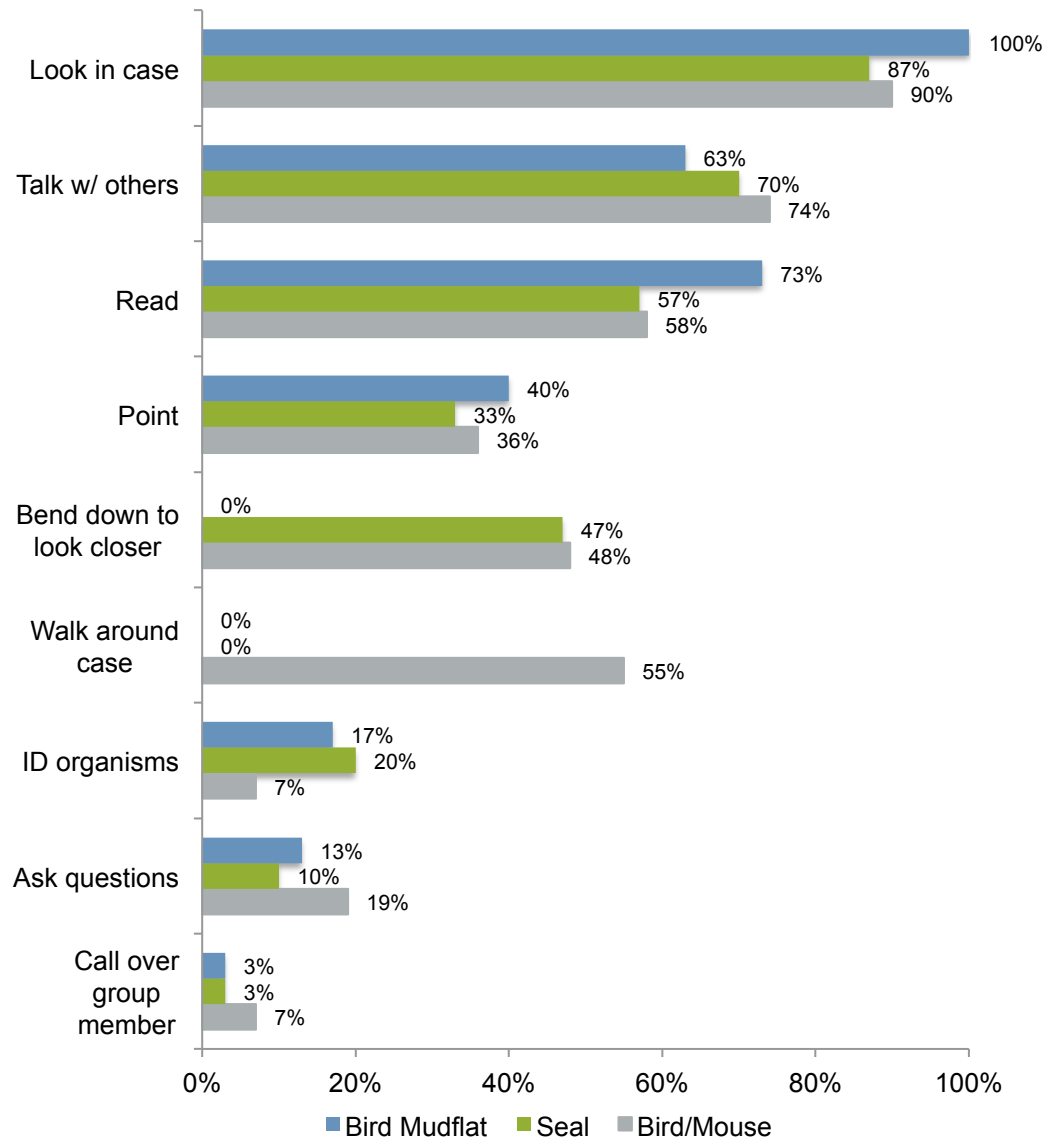
Demographics

- The majority of interviewed families (81%) were adult-only groups. The rest of them included adults and kids (10%), adults and teens (7%), and adults, kids, and teens (3%).
- The majority of families (77%) consisted of 2 members. The average group size was 2.
- The vast majority of groups (83%) said that English was their native language. A small percent (17%) reported English to be their second language but that they spoke it fluently.
- The majority of respondents (74%) were female.
- While interviewees represented a wide range of age groups, respondents in their 20s (23%), 30s (29%), and 60s (29%) were dominant.
- Respondents were primarily Caucasian (63%). In addition, 17% were Asian/Pacific Islander, 17% Hispanic/Latino, 7% African-American, and 7% Native American.
- Slightly fewer than half (43%) the interviewed families were first-time visitors to the OMCA.
- Just 29% were members of the OMCA.
- About one third of the interviewees (33%) were first-time visitors to the Gallery.
- The vast majority of visitors (90%) said that they had experience, background, or interest in nature. When asked specifically what type of interest/experience they had, they mentioned camping, hiking, biking trips, or just enjoying nature/being outdoors. Additional experiences mentioned included bird watching and salmon fishing. Several respondents said to having professional/career related interests in nature, being students of cell biology or environmental studies, a park ranger, or a scientist.

Behaviors

- Visitors' most frequent interactions with the exhibits involved looking at the cases, talking with the others in the group about what they were seeing, and occasionally reading the text. Far less often, visitors attempted to identify organisms, point, walk around the case, or ask questions.
- Slightly more visitors (73%) read the labels at the Bird/Mouse case compared to any of the other 2 cases, where just 58% of respondents at the Bird Mudflat and 57% of respondents at the Seal reported to have read the labels.
- There was no other significant difference in behaviors among the 3 exhibits.

Figure 6. Behaviors observed at Oakland dioramas



Main theme

When asked to identify the main theme or idea that the exhibits were trying to convey, groups provided a wide range of responses. Nevertheless, the majority of them clustered around 2 main ideas:

- Wild life in the inter-coastal area: About 40% of respondents saw the main theme uniting the 3 exhibits as one that presented the diversity of plant and animal life in the areas between land and water (marshes, mudflats, etc.) and how animals interacted with the environment and with each other in these habitats.
- Adaptation: 40% of respondents also mentioned the idea of adaptation as the main message to the audience. They talked about animals struggling to adapt to the conditions of the environment in order to survive.

- Others (20%) had a more general perspective. According to them the main theme involved animals in their habitats. A lot less frequently respondents mentioned terms such as symbiosis, life cycles, diversity of species, ecosystem, and environment to describe the main idea of the exhibits.

Table 27. Respondents’ perceptions of main themes

	N	Percent
Wildlife in the inter-coastal area (marshes, mudflats, beach)	12	30%
Adaptation	12	30%
Animals in their habitat	6	15%
Symbiosis	4	10%
Life cycles	3	8%
Diversity of species	1	3%
Ecosystem	1	3%
Environment	1	3%

Depiction of Time In Exhibits

- About half of the respondents (53%) agreed that the exhibits show time in some way. When asked to elaborate, about one third of the respondents (32%) saw the discussion of tides and seasons as one that illustrated changes through time.
- At the same time, 20% of the visitors saw the scenes depicted in the dioramas as illustrating a moment in the past. There were two reasons for that: a) the cases looked outdated, created decades ago and b) other respondents felt that current habitats have been dramatically affected by human activities and the exhibits represented a time in the past when they were pristine and untouched.

Table 28. Respondents’ perception of time

	N	Percent
Tides and seasons	8	40%
Presents animal scenes from the past	5	25%
A moment in time	2	10%
Evolution (change over time)	3	15%
Shows present time	1	5%
Time it took to create the habitat	1	5%

Connections

- The exhibits reminded the majority of respondents (87%) of a place. When asked what place the exhibits reminded them of, the majority of respondents named very specific places they had visited during vacations or camping trips, or had lived near.
- While 87% saw the exhibits as reminiscent of place they had visited, slightly fewer (69%) said to feeling connected to the particular place as a result of visiting the exhibits, When asked to identify specific places that they felt connected to as a result of visiting the exhibits, respondents provided a wide range of responses. The majority named specific beaches in California.
- Several respondents provided more general responses, such as “California,” “the Philippines,” or the environment in general. Research revealed that most visitors formed connections with nature based

on memories of places that they had visited during camping/hiking/boat trips as well as places they had lived during childhood or lived now. Others were able to develop appreciation for nature through exploring and learning about it; this was the reason they generally felt connected to certain places or the whole natural environment. These findings are not surprising as they support previous research on the topic.

- The majority of respondents, 48% reported that the exhibits sparked some emotion. Seventeen percent said they felt admiration for the beauty and diversity of nature. They enjoyed being immersed in these natural environments. They often expressed pride from living in those places and a desire to conserve and preserve them. Others (17%) felt sad thinking about the animals (the seal in particular) losing their habitats or being exposed to unfavorable human actions. Thirteen percent expressed excitement at seeing the animals.

Table 29. Respondents' emotional reactions

	N	Percent
Admiration for nature	4	17%
Sadness about the animals	4	17%
Excitement at seeing animals	3	13%
Calmness/serenity at being in nature	2	9%
Desire to go out and see it	2	9%
Impression with detail	1	4%
Memories of past events	1	4%
Surprise to see variety of species	1	4%

Visitors, upon learning that these exhibits depicted the Oakland salt marshes, said they did feel a deeper connection to these exhibits. Nearly 79% of them gave positive responses to the question, "Does knowing that these exhibits depict the Salt Marshes and Mudflats in Oakland make you feel more connected to or make you care more about that place in any way?" Nearly half of the respondents (46%) said that it made them more aware and curious to go and explore those places. Others (21%) realized that those places were not so far from their home and made them proud of living in Oakland. Some (14%) said that knowing what those places were made them care more about habitat preservation.

When probing even deeper to fully understand whether visitors form connections with natural places based on the exhibits themselves or knowing the places they represented, more than half of the respondents (60%) stated the importance of knowing the specific place depicted in the scene. Their reasons included that: a) they felt connected to the place, knowing that it is in their "backyard" and b) they felt more inspired to go out in nature and visit it. About 24% of the respondents made both these points. They thought knowing the place that the exhibits depicted, as well as the ideas that the exhibits communicated about the natural environment and the wildlife, were equally important.

Diorama 3. Yosemite

A total of 31 groups were observed and interviewed between the dates of June 14, 2009 and August 23, 2009.

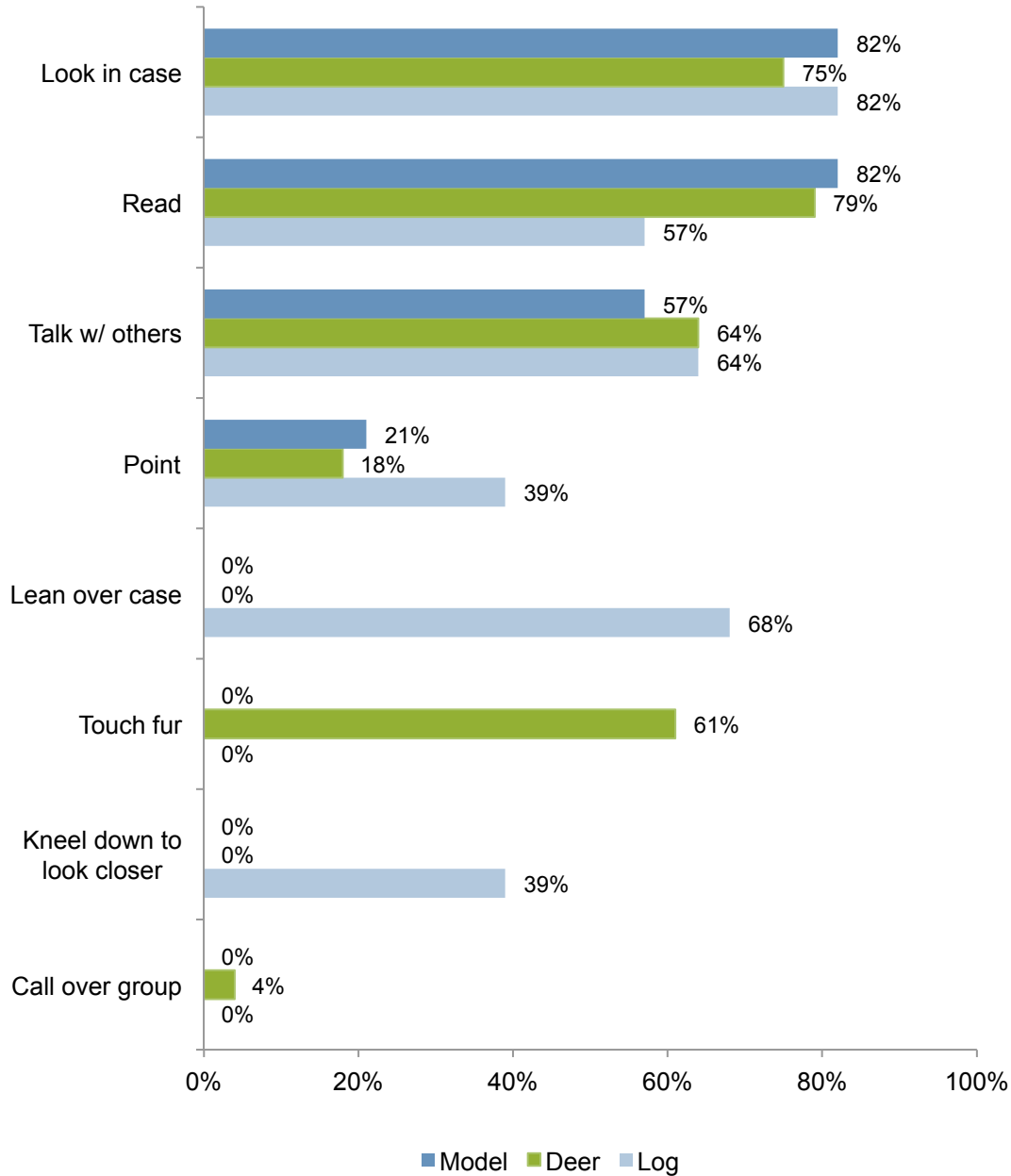
Demographics

- The majority of interviewed families (71%) were adult-only groups. The rest of them included adults and kids (23%), adults and teens (3%), and adults, kids and teens (3%).
- The majority of families (61%) consisted of 2 members. Average group size: 3
- The vast majority of respondents (83%) said that English was their native language. A small percent (7%) reported that English was their second language; 10% reported that while English was their second language, they spoke it fluently.
- There were slightly fewer male respondents (42%) than female.
- While interviewees represented a wide range of age groups, there seemed to be slightly more older respondents: age 40s (23%), 50s (19%), and 60+ (36%).
- Respondents were primarily Caucasian (73%). In addition 17% identified as Asian/Pacific Islander, 4% were Hispanic/Latino; 4% were Native American, and 4% provided "Other" in response to race/ethnicity questions
- Fewer than half (39%) of the interviewed family members were first-time visitors to OMCA.
- Just 24% were members of the OMCA.
- Slightly fewer than half of the interviewees (43%) were first-time visitors to the gallery.
- The vast majority of visitors (89%) said that they had experience, background in, or interest in nature. When asked specifically about the type of interest/experience, they primarily talked about going on camping, hiking, and backpacking trips or just enjoying nature/being outdoors. Additional experience mentioned included fishing, bird watching, nature museums, and TV nature shows. Several respondents said to having professional/career related interests in nature such as being students of geology or professors of ecology.

Behaviors

Overall, visitors' interaction with the exhibits involved looking at the cases, talking with the others in the group about what they were seeing, and occasionally reading the text. In general, there were no major differences in behaviors among the 3 exhibits. Visitors at the Log case, however, read labels less frequently than visitors to any of the other 2 cases. In addition, visitors at the Log case had to lean over the case or kneel down to look closer far more often than groups at the other 2 exhibits.

Figure 7. Behaviors observed at Yosemite dioramas



Main theme

When asked to identify the main theme/idea that the three exhibits were trying to convey, a quarter of groups (25%) were unable to see one overarching theme but rather two separate ones. They thought that the Log and Deer case represented animals' relationships and adaptation to the environment, while the Half Dome exhibit provided more of a reference point that illustrated the location of those habitats.

The rest (75%) offered a wide range of responses in terms of main theme or idea uniting all three exhibits. Some of the more frequently stated ones were: Animals in their natural habitats and Yosemite and from macro (Half Dome) to micro (Log) view. (See table with details about the other categories)

Table 30. Respondents' perceptions of main themes

	N	Percent
No overarching theme (each separate)	7	25%
Animals in their natural habitats	4	14%
Yosemite: from macro and micro view	3	11%
Environment preservation/awareness	2	7%
Forests in general	2	7%
Relationships in nature (how animals interact)	2	7%
Terrestrial ecosystem	2	7%
Wildlife in the Sierra	2	7%
CA environment	1	4%
CA wildlife	1	4%
Yosemite wildlife	1	4%
Geology	1	4%

Depiction of Time In Exhibits

A high percentage of respondents (79%) agreed that the exhibits showed time in some way. Of those participants, 44% saw the scenes depicted in the Log case as illustrating the process of deterioration, which happens over time. While a quarter mentioned the Deer exhibit, noting that it showed time through the demonstration of seasonal changes in the shedding of the deer fur.

Table 31. Respondents' perception of time

	N	Percent
The process of tree deterioration	16	44%
Seasonal changes: shedding of the fur	9	25%
The process of glacial structuring	4	11%
Seasonal weather changes	3	8%
Snapshot of present time	1	3%
N/A	3	8%

Connections

- For majority of respondents (93%), the exhibits were reminiscent of a particular place.
- More than half of respondents (55%) were reminded of Yosemite, and even more specifically the Sierras in Yosemite, when looking at the Half Dome Model. They often referred to memories of visiting those places.
- Some groups were able to name specific places such as Sequoia National Park or Mount Kilimanjaro (see table for details), while others gave more general responses such as “Canada” or “Wisconsin.” Most respondents mentally connected those places to events from their childhood—for example, backpacking and camping trips or familiar areas near their homes.
- When asked if they felt a connection to a particular place as a result of seeing the exhibits, the majority (68%) of the respondents responded positively. When asked about specific locales, they named a wide variety of places to which they felt connected (see table). Nearly half (47%) named

Yosemite as the place to which they felt most connected. The reasons for this stem from childhood memories or hiking/camping trips with friends and families personal to them.

- Just over a third (32%) of participants said “yes” when asked if the exhibits sparked any emotions. Eleven percent said they felt love and admiration for the beauty of nature. Another 11% stated it made them feel relaxed and calm because it was like being immersed in nature. Respondents also identified some not-so-positive emotions triggered by the exhibits. One group thought the termites were “creepy,” another group was concerned about the environment, others felt nostalgia, and some felt sad at the sight of taxidermy animals.

Table 32. Respondents’ emotional reactions

	N	Percent
Love for nature	2	11%
Relaxation	2	11%
Creepy (looking at termites)	1	6%
Environmental concerns	1	6%
Fear of heights	1	6%
Nostalgia	1	6%
Peaceful	1	6%
Sadness at taxidermy animals	1	6%
N/A	4	22%

Participants were also asked about the extent to which knowing the place depicted in the exhibits affected their emotional connections with that place or their experience with the exhibits.

- When asked specifically, half of the respondents could recognize the scenes in the exhibits as representative of Sierra Nevada Mountains in California.
- A large percentage (68%) also said that they had visited this area before.
- More than half (61%) said that knowing these exhibits depict the Sierra Nevada Mountains in California made them feel more connected to the place. Since the majority had already visited the mountains, the connection was based not only on learning about the place but also by their own experiences. Respondents said that identifying the place a) inspired curiosity to go and visit it, b) made them more interested and wanting to learn more, c) increased their awareness of habitat preservation, and d) made them realize that it is not so far from their home.
- In probing even deeper to fully understand whether visitors form connections with natural places based on the exhibits or on personally knowing the places, results revealed that neither construct was dominant. Almost half of the respondents (44%) thought the exhibits themselves facilitated a very strong connection to the places depicted. They enjoyed feeling immersed in nature, observing the wildlife and the details of the dioramas, regardless of the place represented. Those who preferred knowing the location (33%) explained that it deepened their connection to the place because they realized it was in California, which gave them an actual opportunity to visit it in person. About 22% of the groups thought both factors were important.