



Remedial/Summative Evaluation Report

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December 1998

Remedial/Summative Evaluation Report for *Animal Eyes*

*It's to help kids understand how other animals' eyes work
and how they compare to ours.*

(an 11-year-old visitor)

Abstract

This report summarizes the findings of an evaluation study of visitors' reactions to the exhibition *Animal Eyes* at the Lindsay Wildlife Museum in Walnut Creek, California. The study consisted of four parts: a critical review by staff; pre- and post-viewing tests with cued visitors; unobtrusive tracking-and-timing observations; and exit interviews. The critical review identified all parts of the exhibition that needed "fixes" before the exhibition traveled to other sites and prioritized the changes by urgency, importance and available budget. Feedback from visitors revealed that adults and children stopped at, on average, 45% of the exhibit elements, and the majority of them read labels, used the interactive devices and understood the main messages of the exhibition.

Exhibition Description

Animal Eyes is a 2,000-square-foot exhibition consisting of 37 exhibit elements, including flat graphic panels and text, captioned models and artifacts, audio and low-tech interactive exhibit units. Interactives include things to touch, lift and peek into, and they demonstrate optic characteristics such as animals that can see at night, field of view and 3-D vision. The target audience is children ages 11 to 14, but the exhibition is intended to appeal to an adult/family audience as well. The ambience is colorful and lively, with large photographs of the eyes of people and other animals. The label text is easy to read, that is, legible and relatively

short. Smaller, technical diagrams of eyes and vision systems offer a more abstract level of information.

The “big idea” for *Animal Eyes* is, “Even though we know how the type, number and position of animal eyes compare with ours, we are still on a quest to understand what they actually see.” The exhibition is divided into sections that feature eye structures (“Different Kinds of Eyes”), color (“Seeing in Color”) and night vision (“Night Eyes”), eye locations (“Different Places on Different Faces”) and animals with more than two eyes (“3 Eyes, 5 Eyes, 8 Eyes, More”).

As a traveling exhibition, *Animal Eyes* is intended for natural history and science museums, children’s museums and zoos. It was partially funded by the National Science Foundation and sponsored by the American Academy of Ophthalmology; it will travel through the Association of Science-Technology Centers (ASTC). The budget for the total exhibit project, including research, design, evaluation, resource and programming materials (e.g., family guide, Braille guide, Spanish translation, teacher guide) and remedial changes before traveling was \$767,000. Approximately \$30,000 was set aside for the costs of making remedial changes.

Evaluation Methods--Before Opening

Early in the exhibition’s development, front-end evaluations were conducted with the target-age children. Three focus groups investigated kids’ attitudes toward museums, their understanding of their own and other animals’ eyes and their interest in learning more about animals’ eyes. The findings were reported in Deliverable #1 (April 1997), and the recommendations were consistent with the exhibit team’s plans to emphasize comparisons between people and animals

through a variety of communication techniques (e.g., models, diagrams, photos, text, touchables), keeping technical terminology to a minimum.

Several rounds of formative evaluations were conducted during the design development phases. Many of the interactive devices were subjected to review by the exhibit team members, the evaluator and the staff and visitors of the Lindsay Wildlife Museum. One exhibit element ("Field of View") was prototyped at the Exploratorium in San Francisco. In many cases, these formative tests resulted in making the label copy (instructions and interpretations) for the interactives more concrete, more closely tied to the communication goals and more reinforcing (e.g., using the same words on diagrams and in captions for diagrams). A few devices were eliminated because they were too misleading (e.g., straws used to demonstrate light passing through the rhabdom of a fly's eye) or the concept was too abstract (e.g., how to show a sea star's eye cup). The formative evaluation findings are summarized in Deliverable #3 (September 1997) and in a supplement report dated Dec. 4, 1997.

I had no idea scallops had eyes and so many eyes.

*I didn't know whales couldn't see in front of them and that dogs
can't see some colors. That's why I came, I have dogs.*

(an adult visitor)

Evaluation Methods--After Opening

After *Animal Eyes* opened to the public on Aug. 13, 1998, the exhibit team wanted to assess the success of the installation as a presentation and establish the exhibition's effectiveness in engaging the public's attention and communicating

the exhibition's messages. To accomplish this, Lindsay staff members, exhibit developers and other museum practitioners engaged in critical discussions about the exhibition. Visitors were interviewed and tested before and after seeing the exhibits. Evaluators unobtrusively watched uncued visitors in the exhibition and noted their behaviors. Each of these different methods will be summarized separately below.

Critical Review

After opening, a punch list was developed by the staff to correct obvious mistakes in design, construction and installation. Most of the problems were mechanical: holes to pass electric cords through cabinet doors were too small; slide holders for Wentzscopes were too big; flip labels were mounted too close together, causing the flaps to bump into each other. Some of the punch-list items could be addressed immediately, but many would wait for remedial design changes back at the fabricator's shop after the Lindsay venue was completed.

Critical review by staff members and anecdotal observations of visitors also led to immediate remedial changes in instructions for interactives and labels for the eye models. These labels were made of easily alterable materials with the intention that they would be modified after the exhibition opened. The exhibit developers could now see how the parts of the exhibits fit into the whole context and scheme--something very difficult to visualize beforehand. Three examples:

- After a child exclaimed at the enlarged model of a human eye, "Oh, look at the elephant's eye!"), a new label was installed that said, "Human eye model (enlarged)."

- The labels that encouraged “Please Touch” were changed to “OK to touch” because some people were so used to seeing warning labels that they misread these as “Please don’t touch.”
- The label next to a microscope said, “You’re looking at the covering of a fly’s eye, called the cornea. It’s divided into hundreds of tiny hexagons.” It was changed to “Dried-up fly’s eye magnified 100 times” because exhibit developers realized that the shape of the units of the fly’s eye was not relevant to any of the exhibit messages. Furthermore, no mention of a fly’s cornea was made in any other nearby graphic to provide supporting information.

All of these changes were made with temporary label materials, with the intention of using more permanent fabrication methods after the exhibition closed at the Lindsay and before it traveled.

At the opening of *Animal Eyes*, the most surprising and obvious disappointment was with the chameleon interactive. The large reptile head, with its movable eyes, was extremely attractive to visitors, but the handle grips used to move the eyes inspired abuse by children. Kids of all ages grabbed the two controls and, with all their might, slammed the rods in and out as hard as they could. A kinder, gentler mechanism was definitely required.

Critical review continued throughout the other evaluation methods. The final punch list addressed many important practical items (e.g., repositioning of flip labels, new handles for chameleon head, revised diagrams and final instructional labels for the interactives). Due to budget restrictions, several design changes and enhancements (discussed below) that the exhibit development team believed would improve the overall success of the exhibition could not be implemented.

Ten percent of the fabrication budget had been set aside for remedial changes, but that turned out to be inadequate to cover all the recommendations from the remedial/summative evaluation. The project directors estimated that 10% of the entire exhibition budget, or about \$75,000, would have covered all the desired changes.

Tracking and Timing (Unobtrusive Observations)

Data collectors were trained to make and record unobtrusive observations of visitor behavior in *Animal Eyes* according to the protocol for tracking and timing in Paying Attention: Visitors and Museum Exhibitions (Serrell, 1998), and they recorded the time spent and stops made by a sample of 38 casual visitors. Half of the visitors were children 10 to 15 years old, and half were adults. (See tracking data sheet in Appendix A.)

In general, visitors walked through the exhibition slowly, stopping often to read and interact with the exhibit elements. The average time spent by the sample of tracked visitors in the whole exhibition was 11 minutes; the shortest time spent by a visitor in *Animal Eyes* was 3 minutes and the longest time spent by a visitor was 27 minutes. There was no significant difference in average time spent by kids vs. adults. A frequency distribution of visitors' total time spent in minutes (see Figure 1) showed a bell-shaped curve, which means that the mode, mean and median are the same or very close (in this case, 9 minutes is the mode, 11 minutes is the mean, and the median is 10).

Given the size of the exhibition (2000 square feet), the visitors' "sweep rate index" (square footage divided by average time) was 182 square feet per minute. Sweep rates of less than 300 square feet per minute indicate that visitors are

moving slowly, stopping often, or spending more than a few seconds at each stop. Sweep rates of less than 200 are not very common among science exhibitions. *Animal Eyes* is among the 25% of the exhibitions (out of 110) with the lowest sweep rates in Serrell's multi-site museum exhibition study (Serrell, 1998). The more time visitors spend, the more engaged they seem to be with the exhibits, and time and engagement are related to learning (Borun, 1998).

Visitors to *Animal Eyes* stopped (on average) at 17 (or 46%) of the 37 exhibit elements. The lowest number of stops made by a visitor was 3 and the highest was 30. Compared to other exhibitions, the percentage of stopping is higher than average in *Animal Eyes*. A frequency distribution of the number of visitors' stops at elements (see Figure 2) showed roughly a bell-shaped curve; the mode is 21-22, the mean is 17, and the median is also 17 stops.

In general, visitors who spent more time made more stops at elements. The percentage of visitors who stopped at more than half of the elements ("percentage of diligent visitors," or %DV) was 45%. A scattergram (see Figure 3) shows a positive correlation of visitors' total times and the percentage of stops they made. Typically, fewer than one-third of the visitors are diligent enough to stop at more than half the exhibit elements (Serrell, 1998), so *Animal Eyes* was apparently unusually engaging.

Almost all (97%) of the visitors were observed reading labels, and 50% of the visitors read at least one label out loud, a behavior associated with learning in exhibitions (Borun, 1998). Compared to other exhibitions, the percentage of visitors reading out loud in *Animal Eyes* is high.

A high percentage of the exhibit elements attracted visitors' attention. Sixteen of the 37 elements (43%) were stopped at by more than half the visitors (20 of the 38 tracked visitors). The most popular elements were: raccoon, whale, Wentzscopes, dog, chameleon, owl and pupil. The least popular elements were the text-only title and introduction panels and other graphics/text-only panels. See Figure 4 for a chart of the relative popularity of all elements.

When exhibit developers discussed remedial ideas to attract more interest to the least popular elements, their suggestions included adding real or dimensional objects (e.g., a nautilus shell, a dried bee, a toy shark) to the flat graphic panels and modifying graphics (e.g., adding a mouse and a dotted line to the eagle picture). A video of animal eyes at the introductory panel would have been attractive, and an audio of a dog's bark at the doghouse doors would have been an added surprise.

If visitors had been enticed to stop a little more often in *Animal Eyes*, the exhibition's tracking-and-timing data would rank it among the "exceptionally thoroughly used exhibitions," that is, those with an SRI of less than 300 and greater than 51%DV. See Figure 6.

Pre-post Test with Cued Visitors

The exhibition's design included five "teaser questions" intended to interest visitors in the subject and clue them in to the different topic areas. The questions, located on introductory panels, were:

Does my dog see color?

How many eyes does a spider have?

What does a fly see?

Why do a raccoon's eyes glow in the dark?

Where are a sea star's eyes?

Exhibit developers were curious to know how many visitors knew the answers to these questions before seeing the exhibits and if visitors could easily locate the correct answers to these questions in the exhibition. To find out, visitors were invited to participate in a special pre-test interview and then were asked to take a sheet with the questions with them as they looked at the exhibits to try to find the answers. (See the test data sheet in the Appendix A.)

The cued pre-post test sample consisted of 40 visitors. Half were children 10 to 15 years old, half were adults. They were selected randomly and approached with the invitation:

Hi. Today, we're talking with people about *Animal Eyes*. Would you be willing to help us? As a thank you for time, we will give you a little gift. (The gift was animal stickers.)

In a brief interview, the data collectors asked them the five questions, then gave them a clipboard and a paper with the questions. Visitors filled out the sheet by themselves and then brought it back to the data collector. The results, in percentage of correct answers, before and after, are shown on Figure 5.

Only 7.5% to 42.5% gave appropriate answers before seeing the exhibits. Some people knew already or guessed correctly about the raccoon and spider. Many people simply said they didn't know the answer, but one person asked about the sea star, "Is this a trick question? Does it have any eyes?" The most common misperception was that a fly sees multiple images.

After visiting the exhibits, 80% to 100% of the cued visitors answered the five “teaser questions” (about dog, fly, raccoon, spider, sea star) correctly. Many people quoted the label copy, used new vocabulary words (e.g., “tapetum,” “eye cup”) and said that the answers were easy to find.

A few visitors still said that flies see multiple images. The exhibit’s label begins with that statement, but ends with a different conclusion. The text reads:

Scientists used to think a fly could see hundreds of separate pictures with its compound eye. Then they learned the pictures from all the separate units of a fly’s eye are mixed together before they go to the fly’s brain. Now scientists believe a fly sees just one picture of the world.

Exhibit developers discussed remedial ideas to change the fly’s eye label, but making a new silk-screened label would have been too expensive. They reluctantly decided to live with it.

Cued Exit Interview (Open-ended Questions)

Exhibit developers wanted to know what visitors learned from *Animal Eyes* and if they understood the exhibition’s main message. Data collectors invited randomly selected adults and children to participate in a brief interview/questionnaire after they looked at the exhibition for as long as they wanted. Questions included: What would you say is the main purpose of the displays in this room? What is one new idea you are taking away with you? Is there anything else you’d like to tell the people who made this exhibition about how it could be improved? (See the questionnaire form in Appendix A.)

Forty visitors were interviewed: 50% were children, 50% were adults. Findings from visitors' feedback on the questionnaire included the following:

- 45% of the children gave an appropriately detailed response to the question "What is the main purpose of the displays?" and 84% of the adults' responses were on target (i.e., related to the big idea of different kinds of eyes, how they work and the ways animals see). For example, "To help people learn more about what eyes really do and how animals see." Combining these scores, 66% of the interviewed visitors who were interviewed understood the big idea. Some of their other answers were very general (e.g., "to teach about eyes"), but none were wrong. (There was one "I don't know" from a child.)

- In response to the question, "What is one new idea you are taking away?", all but one child and one adult gave at least one new idea. Eleven visitors mentioned something related to seeing color. Nine visitors mentioned the exhibit element about field of vision. For example, "The way animals see to the side or in front or can do both. That's neat."

- Specific animals mentioned were: dogs, whale, scallop, sea star, bees, horseshoe crab, bug, worm and owl. Other specifics included Dr. Cronin, red eyes, mirror, "split-open" models of eyes, and 3-D vision.

- In response to the question, "How could the exhibition be improved?", many visitors made a positive remark. Actual suggestions included "more for little kids," "have a computer to learn more," "some type of video" and "make everything interactive."

A transcription of all of the visitors' feedback is in Appendix B.

Although visitors got the basic big idea, the more subtle message that "seeing happens in the brain and therefore we do not know exactly what animals see" was not communicated to most visitors. This message was stated clearly on only

one panel. A remedial suggestion (for future exhibits) was to integrate that message more completely throughout the exhibition.

Demographics of the Visitors Sampled in the Evaluation

The total sample consisted of 117 visitors, and 51% were children (between the ages 10 and 16) and 49% were adults. A majority (69%) were females. Many of the visitors to the Lindsay are women with children under 5 years old.

Of the cued visitors (n=79), only 11 people had come to the museum especially to see *Animal Eyes*. Most of them (7 of the 11) had heard about it through some form of media (e.g., TV, newspaper, members' notice); the others had heard about it from a relative or friend. It was the first visit to the Lindsay for 55% of the sample, and 23% of them had "a special interest" in eyes. Examples of special interests were "wears glasses," "studied anatomy and biology in college," and "saw cow's eye dissection at Exploratorium."

The average amount of time spent in the exhibition by uncued and cued visitors was not significantly different, but cued visitors (pre-post test and exit interview samples), on average, spent longer times. This was not surprising because previous evaluations have shown this trend.

Discussion

The purpose of the evaluation was to establish the exhibition's effectiveness in engaging the public's attention and communicating the exhibition's messages. The exhibit developers wanted to be accountable to their funders and to make informed decisions about needed improvements to the exhibition before it

traveled to different sites. Thus, the evaluations had both remedial and summative functions.

The evaluation data showed which exhibit elements were most and least popular, how thoroughly visitors investigated the whole exhibition, what visitors thought the main messages of the exhibition were and which parts were most memorable.

Animals with eyes on the side are more worried about what they see behind them.

Animals with the eyes on the front aren't as afraid of what's behind them.

(a 10-year-old visitor)

The most surprising finding was that “Field of View” was memorable to many children and adults. The exhibit developers had not anticipated this; in fact, they debated whether to leave it in because it seemed so static and pedantic. They were also pleased that visitors found the labels interesting and easy enough to read out loud to each other. “Look--It’s a dried-up fly’s eye!” was commonly exclaimed from the label text next to one of the microscopes.

The fact that several visitors did not learn about the fly’s eye forming one image instead of multiple images and the misreading of the “touch” labels reminded the exhibit developers of the importance of front-end evaluation. It allows them to understand what visitors think, know, and expect and to make concept, design and content work harmoniously to reinforce what visitors already know and address misconceptions in ways that will help visitors construct new meanings.

For remedial purposes, questions were raised about which of the less popular and less memorable of the 37 elements could be made more attractive and more engaging for visitors.

- While the credit panel was not intended as a “hot” item, it serves an important function, informing visitors of the many different talents needed to develop and present an exhibition; therefore, it was counted as an element.
- The title and introductory panels did not successfully stop many visitors--a commonly observed failing in many exhibitions--because people are on their way into the space, drawn by colorful graphics and interesting-looking objects. An attention-getting element, such as a video, would probably help visitors stop there.
- Dimensional objects, such as a real (dried) bee, a real nautilus shell and a small shark model might have attracted more visitors to those panels with graphics only.

Unfortunately, the budget did not allow for as many changes as were desired.

As for the chameleon exhibit, the exhibit developers blamed themselves, not the visitors, for the inappropriate use the handles inspired. The design of the grasp-type devices clearly invited abuse in the form of full-body participation. Perhaps the new five-inch wheel-knobs will inspire smaller motor movements.

The tracking data showed that visitors investigated *Animal Eyes* relatively thoroughly, exploring many of the exhibit elements and reading labels. Interview data provided evidence that they understood the exhibition’s messages and enjoyed seeing it. After remedial changes, an evaluation study planned for the first travel venue will investigate the exhibition’s success and effectiveness at another site.

I always knew that animals' eyes were different, but I never put it all together.

(an adult visitor)

References

Borun, Minda, et. al. 1998. *Family Learning in Museums: The PISEC Perspective*. Philadelphia/Camden Informal Science Education Collaborative, The Franklin Institute, Philadelphia, Pa.

Serrell, Beverly. 1998. *Paying Attention: Visitors and Museum Exhibitions*. American Association of Museums, Washington, D.C.