Climate Change: Engaging Audiences, Prompting Action,Measuring Change

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Climate change is a pressing concern and a challenging topic to present to guests. San Diego Zoo Global set out to integrate the topic of climate change into its Polar Bear Plunge exhibit. A story-based narrative explained the effects of polar ice loss on polar bears. The experience concluded with a call to action for guests to reduce CO2 emissions. Results of an exhibit evaluation indicated that exhibit visitors had significantly more recall of the exhibit's key messages, and expressed more frequent intents to engage in CO2-reducing conservation measures, relative to those in a matched comparison group.

Climate change is among the most significant environmental challenges faced by the world today. Zoos, and zoo educators, are increasingly pressed to address this challenge since it is having a profound effect on weather patterns, habitats and the animals those habitats contain. As professional educators they are well equipped to convey key facts, and provide interpretation of the challenge in ways that resonate with guests. Exhibits, programs, and periodicals provide the means of presenting the topic to visitors and other constituencies. However, broaching the subject can prove challenging. Concerns that involve political, religious, and scientific sensitivities can impact the zoo educator's work.

This article presents the systematic design of an interpretive experience, featuring polar bears, which focused on the theme of climate change. Results of an exhibit evaluation are presented to illustrate the exhibit's impact.

Climate Change Background

Climate change has occurred on this planet multiple times during Earth's history. This has resulted both during climatic periods of high and low temperatures. In the past, natural factors alone drove changes in our climate, but with the advent of the Industrial Revolution in the 18th century, the composition of our atmosphere has changed due to human impact.

Some of the human activities believed to be driving this change include the burning of coal and oil, urbanization, and deforestation. These human actions have led to increases of greenhouse gases, which act to trap heat in our atmosphere and result in increases in Earth's temperature. Data collected by NOAA and NASA indicate that "Earth's average temperature has risen by 1.4°F over the past century, and is projected to rise another 2 to 11.5°F over the next hundred years" (United States EPA n.d.). Other changes seen during this period are differences in rainfall patterns, sea level, and ice cover.

Where do all of these greenhouse gases, primarily CO_2, come from? They result mainly from buildings, vehicles, and industry. In fact, buildings, not cars, create most of the CO_2 in the U.S. (Miller 2009). And the U.S. is responsible for one-fifth of the world's CO2 emissions, or about six billion metric tons per year. What is surprising is that the amount of emissions in the U.S. is predicted to increase to seven billion metric tons by 2030, due to growth in the economy and population. Thus the U.S. population is one of the biggest contributors to CO_2 emissions.

With the estimated increases in CO_2 emissions in most areas of the world, all sectors should review their CO_2-generating habitats and develop a plan to reduce them. But whether dealing with a business or a family, changing behavioral patterns is very time consuming and difficult, and replacing high-emission equipment and appliances is most often cost prohibitive.

If behavioral change is going to happen, people must be given not only a reason to care about the subject but also guidance and the appropriate tools.

Interpreters at the San Diego Zoo envisioned the existing Polar Bear Plunge exhibit as the perfect means to provide Zoo visitors with both guidance and tools.

Engaging Visitors with Climate Change

With conservation as its core mission, San Diego Zoo Global set out to address the topic of climate change with visitors to its San Diego Zoo campus. The work focused on a complete redesign of the Zoo's popular Polar Bear Plunge exhibit.

Working with a US$1.1 million gift from local philanthropist Conrad Prebys, the reimagined interpretive experience immersed visitors in a story about polar bears. Storytelling is a time-tested, research-proven approach to relaying information (Schank and Abelson 1995). The use of storytelling, anchored in concepts familiar to the visitor, further facilitates the transfer of information (Keller 2010). Thus, the visitor's mind (cognitive load) can focus on the content-related messages, rather than the strategy being used to present those messages (Chandler and Sweller 1992).

Pairing the polar bear species with climate change was a deliberate decision. The interpretive designers believed that link, between animal and climate change, would be one that visitors would fully grasp. This also can support visitors making the connection between exhibit and conservation action in their daily lives (Mann 2012).

The exhibit's story now presents natural history information about the polar bear along side data-based facts about the loss of polar ice, and its impact on polar bear reproduction and survival which has lead to the polar bear's threatened status. The story ends with a simple graph charting the increase in CO_2 levels over time, and actions anyone can take to reduce CO_2 levels locally.

Table 1: Exhibit Interpretive Element Descriptions

Element	Description
Storybooks	Visitors begin by reading a story about polar bears from three super-sized, six-page illustrated storybooks that reveal facts about the polar bears, tell the tale of how the bears can to live at the San Diego Zoo, and show how researchers learn more about this top Arctic predator (Figure 1).
Measure-up	Refrigerators, polar bear statues, scale. Life-size statues allow visitors to stand next to a full-grown adult bear (Figure 2), cozy up to a one-year old cub, and marvel at a tiny newborn. A giant scale helps visitors see how many people it takes to match an adult male polar bear's 1,500 pounds. Visitors can open a refrigerator to compare the amount of food a polar bear eats to their own average food consumption (Figure 3).
Interpretive Cart	Stationed at a cart, visitors can interact with a knowledgeable interpreter and touch skulls and other artifacts.
Polar Bear Den	Female bears create snow dens in which to give birth and shelter their cubs. Visitors can crawl into a replica of a polar bear den and see just how snug it is. They can check out the seal breathing holes in the ice to see how polar bears hunt for food, waiting for a seal to pop up (Figure 4).
Experience Wall	At the Experience Walls, visitors have the opportunity to "meet" the polar bears, and their keepers. At various times, keepers will open the large glass panels and interact with the bears through only wire mesh.
Research Helicopter	Researchers rely on helicopters to find polar bears in the Arctic. Visitors can climb into a real helicopter and discover what researchers are looking for on their flights and how they keep track of bears they are studying.
It's Melting	Visitors approach two displays showing sculpted, three-dimensional maps of Hudson Bay, created from actual NASA satellite images taken in 1989 and 2007. They can review how the Arctic sea ice has changed in less than 20 years and touch the cold "ice packs" (Figure 5).
Carbon Graph	This large, three-dimensional graph illustrates the CO_2 concentrations in the atmosphere during the last 300 years. The graph demonstrates how the levels have increased since the onset of the Industrial Revolution, the current level of CO_2 in our atmosphere, and the projected continuing increase in levels if humans do not take action. Some of the largest contributing factors are the use of electricity and natural gas in homes. Visitors discover ideas here for simple things they can do right now in their own lives to make a difference (Figure 6).

(Table contents "Explore the Exhibit" n.d.).

Key Messages Frame Systematic Design and Evaluation

Three key messages, and 15 submessages, were defined as an initial step in the interpretive experience design process (shaded areas of Table 1 detail the three overarching key messages).

The submessages further defined pieces of information guests would receive under each of these three areas. Together, the messages supported the systematic design of the interpretive elements, and ensured a consistent focus throughout the experience. By defining the knowledge visitors would acquire through the interpretive experience, the key messages also provided the "blueprint" around which the interpretive elements were designed, and the outcomes the exhibit evaluation was designed to measure.

Polar Bear Plunge Today

Today's exhibit presents the Zoo's Polar Bears in a dynamic interpretive experience. Often, climate change is addressed in exhibits with significant amounts of text and complex displays as well as providing great detail on the science and politics of the issue. The approach presented here was just the opposite. A simple story, framed by polar bears, framed the information presentation. Text panels were purposefully kept simple and headlines conveyed key messages. Displays and interactive features were used to gain the visitor's attention and relate the relationship between polar bears and climate change.

Materials and Methods

To better understand the impact of the reimagined interpretive experience, San Diego Zoo Global commissioned an exhibit evaluation. The study measured exhibit outcomes specific to the interpretive experience, visitor retention of key messages, and visitor intended action in response to conservation messages. Guided by the key messages that were established by the exhibit design team, the evaluator crafted an iPad-delivered survey instrument, and then collected data from 500 visitors.

The evaluation featured a quasi-experimental, single-measure design. An equal number of visitors were approached (a) prior to entering the Polar Bear Plunge exhibit – the "baseline" group (n=250), and (b) following their viewing of the exhibit – the Polar Bear Plunge (PBP) group (n=250). Among our reasons for collecting baseline data at the exhibit entrance was an attempt to control for visitor interest. All members of our final sample had interest in the exhibit, as evidenced by the fact they all intended to, or had, visited Polar Bear Plunge. Visitors were recruited with purpose to balance the two groups based on demographics of gender, age, and San Diego Zoo Global membership.

Results & Discussion

Almost 80% of the PBP group indicated they learned something new about polar bears as a result of their exhibit experience; 63% learned something new about climate change.

Interpretive Elements Viewed and Read

These learnings likely stem from the interpretive elements featured in the exhibit. On average, visitors viewed and read 3.14 of the seven interpretive elements, excluding the interpreter cart that is not always staffed. This average includes the over 47% of visitors who viewed and read four or more elements.

The polar bear statues and refrigerator with the polar bear diet inside proved to be the most impactful element, with 64.0% of visitors recalling these elements. However, the majority of visitors also indicated viewing and reading:

Polar Bear Den (54.0%)
It's Melting (55.2%)
Carbon Graph (53.6%)

Of particular note, just under 7% of exhibit visitors indicated they had not viewed or read any of the exhibit elements. This occurrence was more prevalent in members (12.5% not viewing or reading), relative to non-members (6.6% not viewing or reading).

Visitor Recall and Intended Action

Analysis of visitor recall and intended action revealed statistically significant results. Visitor knowledge differed between those who had experienced the exhibit and those who had not, with Polar Bear Plunge visitors demonstrating more knowledge of key message-related content and ideas. Table 2 highlights findings between the baseline and Polar Bear Plunge (PBP) groups, for each of the three key messages.

Overall, a significant difference among age-defined groups existed only for one item that queried about the cause of climate change. This difference involved the 10-17-year-old group whose answers differed significantly when compared to both the 18-29 and 30-64 age-defined groups. Fifty percent (50.0%) of the 10-17 age group respondents (PBP group) answered this question correctly. This differs significantly when compared with the 18-29 age group (86.1% correct) and the 30-64 group (85.5% correct). Aside from this question, there were no significant differences in performance based on the visitor's age.

Conclusion

Results of the study favor, with statistically significant differences, the Polar Bear Plunge group's performance across each of the three targeted key messages. Findings within the Polar Bear Plunge group were constant, regardless of gender or San Diego Zoo Global membership. Further, the majority of visitors engaged with just under half of the exhibit's elements, and reported favorable overall ratings of their experiences. We conclude that the defined key messages, supported by the polar bear species, and related to guests through a compelling storyline and with eye-catching and thought-provoking interpretive elements, supported reliable acquisition of targeted knowledge.

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Table 2: Summary of Evaluation Findings

Key Message 1: Polar bears live in the Arctic and rely on sea ice habitat for hunting and creating dens.
Relative to the Baseline Group's performance: ▪ **11.0%** more of the PBP group members were able to correctly identify the polar bear's primary food source—a statistically significant difference ($p \leq .01$) ▪ **2.8%** more of the PBP group members were able to correctly identify the reason behind single births (versus the historical trend of twins)
Key Message 2: The Earth's temperature has increased 1.2 to 1.4 degrees over the last 100 years, a result of climate change.
Relative to the Baseline Group's performance: ▪ **25.6%** more of the PBP group members were able to correctly identify CO_2 emissions as the cause of climate change—a statistically significant difference ($p = .000$) ▪ **8.8%** more of the PBP group members were able to correctly state that the earth's temperature has increased over the last 100 years—a statistically significant difference ($p \leq .01$) ▪ **6.0%** more of the PBP group members were able to correctly identify homes as the primary source of CO_2 emissions in the United States—a statistically significant difference ($p \leq .01$)
Key Message 3: The San Diego Zoo empowers people to steward nature locally and globally.
Relative to the Baseline Group's performance: ▪ **1.2%** more of the PBP group members were able to correctly identify attributes of the San Diego Zoo Global and Polar Bears International partnership ▪ PBP group members were almost twice as likely to indicate they would begin buying local grown food as a conservation measure: 20.4% vs. 13.6% in the baseline group—a statistically significant difference ($p \leq .04$) ▪ PBP group members were more likely to indicate they would begin unplugging appliances when not in use as a conservation measure: 27.6% vs. 19.2% in the baseline group—a statistically significant difference ($p \leq .03$)

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