# Final White Paper Report

## Inform and Engage: New Exhibit Methods for Education, Enrichment, and Conservation

## FY 2015 Sparks! Ignition Grant # MG-45-15-0018-15

### 1. Administrative Information

| | |
|---|---|
| Institution: | Indianapolis Zoological Society |
| Project Title: | Inform and Engage: New Exhibit Methods for Education, Enrichment, and Conservation |
| Award Amount: | $20,193.00 |
| Project Start and end dates: | August 01, 2015 - July 31, 2016 |
| Project Director: | Christopher Martin (CMartin@Indyzoo.com) |

### 2. Project Summary

Zoos with endangered species in their collections are in a unique position to garner public support for conservation initiatives. Orangutans, the target our Sparks project, are highly intelligent animals with a critically endangered status in the wild. Grant funds were used to add new content and capabilities to our daily orangutan cognitive demonstrations with the goal of educating guests about orangutan intelligence and encouraging participation in a crowd-funded conservation effort. We created a three minute infographic animation about orangutan behavior and conservation to show guests prior to the demonstrations, and developed a unique interactive opportunity for them to interact with the apes through a shared touch-panel computer game. A study was conducted to test the impact of guest exposure to the video on donation patterns at an on-site conservation donation kiosk. We hope that our Sparks! Grant related activities may serve as a model for conservation-oriented public engagement at zoos.

### Needs and Rationale

Countering the rapid loss of biodiversity around the world will require future conservation efforts to be bolstered by broad public awareness and the long-term support of younger generations. With many endangered species represented at America's zoos, these institutions are ideally situated to assume a vital role in educating students and empowering communities to make a difference for animal conservation. As zoos shift their priorities toward becoming conservation epicenters, a new generation of exhibits is needed to serve audiences with meaningful experiences that will foster both an appreciation for endangered animals as well as a concern for their survival in the wild. Along these lines, the current project was aimed at the development of a novel exhibit concept to raise awareness and support for a critically

endangered species, orangutans, and to provide zoo visitors with an innovative opportunity to learn about and interact with the apes using technology.

In addition to advancing animal conservation outside of their gates, modern zoos are also increasingly looking for ways to enrich the daily lives of the animals under their care. Orangutans, the target species of the current proposal, are highly intelligent apes that utilize in their natural habitat a large repertoire of skills to navigate through dense forest canopies while foraging for food. In considering how captive orangutans may be adequately cared for, it is incumbent upon zoos to develop methods for providing physical and mental activities that are tailored to reflect the species-typical behavior and cognition of orangutans in the wild. Typical "enrichment" for orangutans in zoos involves the provision of disposable objects (often with food hidden inside) that serve to capture the apes' attention for a very brief period of time. A more sophisticated and versatile form of enrichment involves the use of technology, and in particular computer touch-panels connected to automatic feeding devices. Computer touch-panels loaded with simple puzzle tasks that dispense food rewards based on the ape's performance have been used for decades to study animal cognition in university research settings, and several zoos have implemented them for the great apes in their collections. These tasks are valuable enrichment tools because they are capable of targeting specific mental skills that are important to wild great apes, such as memory and spatial reasoning, and in a similar way to the foraging activities of wild apes, they enable intermittent food intake over extended bouts of mental and physical effort.

Despite the enrichment potential and the successes of the few zoos that offer voluntary computer touch-panel activities to their apes, the practice has never gained enough traction to become widely adopted. This is likely due to the prohibitive costs of equipment and the need for specialized staff, but it may also be reflective of the limited objectives that zoos have traditionally placed on the usage of their touch-panels. Zoos that have implemented ape computer touch-panel programs have typically done so mainly for the purpose of scholarly research, and have given relatively less consideration to the potential for public education, behavioral enrichment, and conservation outreach. The current project, which included a new computer system that enables visitors and apes to directly interact with each other over computer screens, gave equal weight to educational, enrichment, and conservation considerations with the hope that such a formula will lead to a widely replicable exhibit platform.

The Indianapolis Zoo conducts daily computer learning demonstrations with five apes inside a touch-panel equipped "learning studio", and has plans for up to nine apes to use the touch-panels. As they work, the apes are in full view of a seating area that accommodates about seventy spectators at a time, and a total average of thee-hundred audience members a day attend the demonstrations during the zoo's busy season. Several large overhead displays are used to show a camera feed of the event and a view of the orangutan's screen. The exhibit also includes

an “interaction station” that consists of two interconnected touch-panel screens on either side of exhibit glass, so that orangutans and visitors can play interactive games or collaborate on shared computer activities. We used Sparks funds to enhance the following mutually-reinforcing aspects of the orangutan touch-panel exhibit: 1) educational enhancements, including the development of explanatory infographics for displaying details about the apes’ computer task procedures and results on the overhead displays 2) enrichment enhancements, including the utilization of new multi-touch touch-panels that are well suited to the orangutans behavioral habits, and 3) conservation enhancements, including the addition of a conservation themed infographic animation shown on the overhead displays. A study was designed and implemented to test if watching the infographic animations and computer touch-panel demonstrations resulted in increased conservation donations to a reforestation effort using kiosks located within the exhibit.

As zoos assume roles as centers for conservation education and awareness, there is a clear need to examine how different exhibit elements serve to raise the willingness of audience members to learn about and support conservation initiatives. The orangutan exhibit at the Indianapolis Zoo includes three electronic kiosks where visitors can donate money to a reforestation project in Kutai National Park on the island of Borneo, Indonesia. A goal of the Sparks project was to understand the impact of new exhibit features on people’s willingness to contribute to conservation efforts. For this purpose, a study was conducted which used a statistical model to examine the impact of the Sparks funded exhibit enhancements on the number and amount of contributions logged each day at the reforestation kiosks.

**Activities Completed During the Project**

The project began with the procurement of equipment and the creation of new educational content to enhance the daily orangutan cognitive demonstrations. Since the opening of the zoo’s orangutan exhibit in May 2014, cognitive researchers Dr. Robert Shumaker and Dr. Christopher Martin had been conducting daily touch-panel based computer tasks with orangutans in full view of zoo guests. These activities had the following goals: 1) to enrich the orangutans daily lives by giving them voluntary opportunities to use computer touch panels, 2) to provide scientific insight into the problem-solving abilities of the apes by studying how they performed on the tasks, 3) to educate zoo guests about the intelligence of orangutans by making the research sessions publically viewable, and 4) to promote wild orangutan conservation.

**Figure 1a**. Daily Cognitive Demonstration in *the Learning Studio.*

**Figure 1b.** Orangutan doing a cognitive task. Sparks-funded plexiglass shelf holds the automatic feeder.

**Figure 1c.** The animated infographic video is shown to guests on the overhead screens.

**Figure 1d.** On-site conservation kiosks offer an opportunity to donate to reforestation efforts.

Cognitive demonstrations were conducted in an exhibit area called *The Tim M. Solso Learning Studio*, which had a seating area that accommodate up to seventy guests at a time (Figure 1a). The cognitive demonstration sessions that lasted around fifteen minutes each, and were typically given four to five times a day with different apes. For the Sparks project, we contracted a graphical design firm to create a three-minute animated infographic video about the behavior and intelligence of orangutans and the need for conservation efforts to maintain healthy population numbers in the wild (For screenshots of the video, and the text of the accompanying narration, see Figure 3). The animated video was designed to be shown in the learning studio prior to the cognitive demonstrations, with the goal of providing some background information about orangutans to guests, and also to inform them of an opportunity to donate to a reforestation effort in Borneo where wild orangutans live.

The creation of the infographic animation took seven months, from September 2015 to April 2016. The process began with the creation of a script, written by the zoo's educational department and Dr. Chris Martin, followed by the bidding out of the videos graphical creation to design firms. TechChange, a Washington DC based design firm, was chosen to make the video. In addition to the creation of the video, steps were taken to procure AV equipment that would facilitate the playing of the video to guests. This included the purchase of a computer and cables

to be connected to the existing overhead monitors in the learning studio. A new Plexiglass shelf (Shown in Figure1b) was also designed and constructed to hold an automatic food dispenser, so the demonstrator was freed from hand feeding the apes and could face the audience to relay information about orangutan intelligence for the duration of the demonstration.

After the video was completed and the new AV equipment was in place, we conducted a statistical study to test the impact of the video on conservation donation patterns at on-site kiosks equipped with a credit card swiping mechanism. The study ran for fifty six consecutive days from June to August, which coincided with the busiest period of the year for zoo attendance.

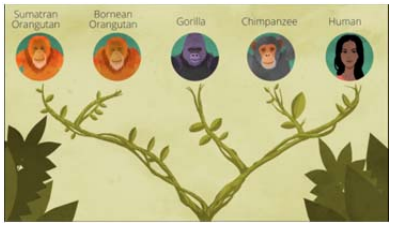
In addition to creating the animated infographic video, we also created a new opportunity for guests to interact with orangutans over a shared touch-panel apparatus known as the Cognitive Interaction Station. Sparks funds went toward the purchase of two new touch-panels for this program. The two interconnected touch-panels were mounted on either side of the exhibit glass such that an orangutan and a human guest could play a game with each other using their respective touch-panels (Figure 2). To commence usage of this new exhibit feature, we created a simple ping pong game in which the orangutan and a human could pass a virtual ball back and forth. A pilot test for the new interactive gaming experience was initiated over the summer, and consisted of a weekly session lasting for about fifteen minutes. During these sessions, the zoo's education department recruited families from the general audience to participate in the game with orangutans.

**Figure 2.** Guests interact directly with the orangutans in shared computer tasks.

**Figure 3. Screenshots and narrative text of the Sparks-funded animated infographic video.**


*NARRATION: "Orangutans are some of the smartest beings in the world. In the forests or Borneo and Sumatra they spend the first decade of their lives learning a long list of skills from their mothers. They memorize what kinds of food to eat, where to find it, when it's available, and in some cases how to acquire it by making and using tools. As the largest primates with a fruit-based diet, and with the highest ratio of arm length to leg length, orangutan minds and bodies are perfectly adapted to navigating and foraging in dense forest canopies. Studies suggest that they move around using mental maps of their environment, and actively plan their movements ahead of time, even announcing to nearby orangutans where they intend to travel up to a day in advance."*


*"At the Indianapolis Zoo, we study the intelligence of orangutans using computer touch-panel tasks. Doing this helps show us how they think about the world using mental traits like memory, symbolic comprehension, and ability to use numbers."*





*"As our fellow great apes, their complex mental abilities offer a special perspective when it comes to studying and understanding our own minds. And yet, largely because of human activity orangutans are on the brink of extinction. In the past century the number of orangutans has fallen by sixty percent in Borneo and eighty five percent in Sumatra. Their decline in numbers is a result of extensive loss of forest habitat caused by logging, mining activities, and the growing trend to replace ancient forests with palm oil plantations."*


*"Today, here at the zoo, you can help wild orangutans by replenishing forests in Borneo through a donation at the zoo's conservation kiosks. Reforestation efforts are vital to maintaining a healthy population of wild orangutans, and securing a promising future for their descendants."*

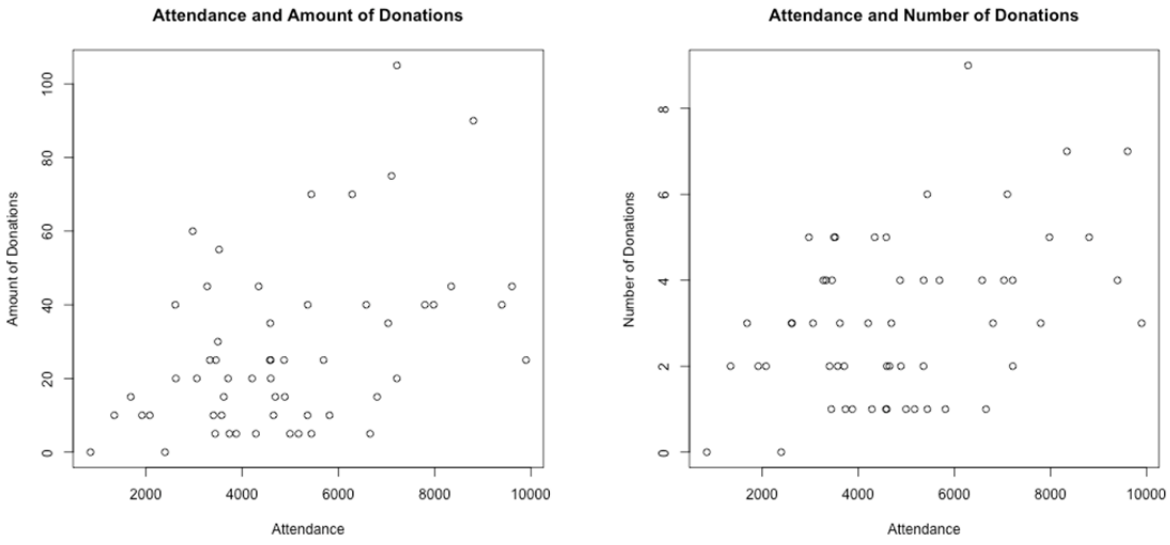
## 3. Project Results

*Conservation Outreach Study: Methods*

After the production of the conservation outreach video was completed, a study was conducted to investigate the relationship between guest exposure to the video and donation patterns at the on-site conservation kiosk (Figure 1d). A pair of professional statisticians from Eli Lilly and Company, Dr. Matt Rotelli and Natalie Cheung Rotelli, designed the study methods as follows: for fifty six consecutive days spanning across June, July, and August, daily cognitive demos were conducted at 1pm each day. On half of the days during this period (twenty eight days) the video was shown to the guests seated in the Learning Studio moments before the orangutans commenced their daily touch-panel activities. On the other half of the days, the video was not shown prior to the cognitive demonstrations. The distribution of the days for the two conditions-- "video" and "no video"-- was randomized so that the video was shown on two out of the four instances of each day of the week that occurred during the study interval. During the study period, the donation kiosks were programmed to collect data on the amount and number of donation for each day, and these data served as the dependent variables for the comparisons between "video" and "no video" days. General attendance numbers collected at the front gate to the zoo served as a covariate in the statistical model, as did the weekday on which data were collected.

*Conservation Outreach Study: Results*

**Figure 4. Scatterplots showing the relationships between zoo attendance and the amount of donations (Left) and number of donations (Right).**



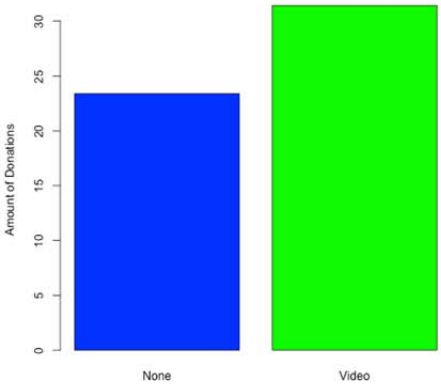



**Figure 5a.** Average total amount of donations on video days (green) vs non-video days (blue).

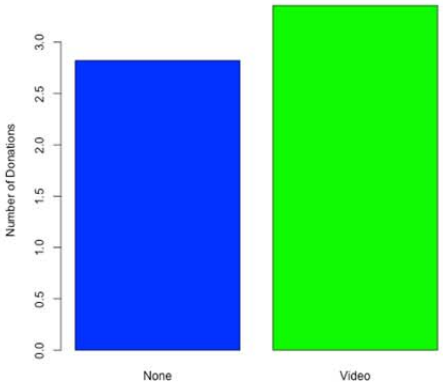



**Figure 5b.** Average number of donations on video days (green) vs non-video days (blue).

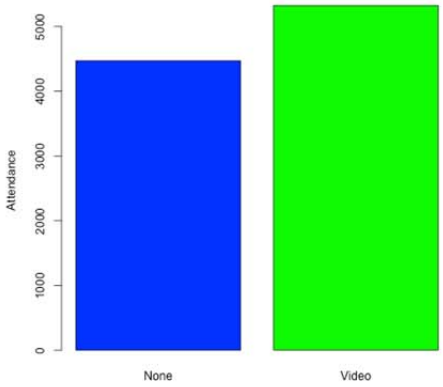



**Figure 5c.** Average number guests at the zoo on video days versus non-video days.

Results of the statistical model revealed the following trends: **1)** Numerical increases on number and amount of donations based on exposure to the video were not statistically significant (ANOVA for donation number, $F(1, 47) = .567$, $p = .455$; ANOVA for donation amount, $F(1, 47) = 1.387$, $p = .245$). **2)** Daily attendance numbers at the zoo had a significantly effect on donation amount and, to a lesser extent, on the overall number of donations (Shown in figure 4; ANOVA for donation amount, $F(1, 47) = 11.754$, $p < .01$; ANOVA for donation number, $F(1, 47) = 3.801$, $p < .01$). **3)** Despite efforts to balance the experimental design by randomizing "video" and "non-video" days over the course of the study period and balancing over days of the week, there were shown to be a nearly significant increase in zoo attendance on "video" days (Figure 5c; ANOVA $F(1,48) = 3.450$, $p = .069$).

Findings showed that there was no significant increase in donations following exposure to the infographic animated video. There was a visible trend showing higher donation rates on days when the video was shown (Figure 5a and 5b); however, this trend was confounded by the finding that the zoo received more overall visitors on days when the video was shown despite efforts to randomize the experiment schedule. This discrepancy may be eliminated in future study designs by extending the period of study. In the current project, there were only fifty six days allotted for the study (28 per experimental condition), coinciding with one summer season, and the short duration was representative of the amount of time (one year) given to complete the Sparks project. As a pilot test, we believe the study succeeded in creating a practical methodology for measuring the impact of our new exhibit features, but for future employment of this method it is likely that significantly longer study duration may be needed to achieve greater statistical power and to eliminate confounding variables associated with smaller sample sizes.

*Interactive gaming with guests and orangutans*

In addition to the study on how the conservation video impacted donation patterns, we also completed a related exhibit enhancement project to create interactive games for guests and orangutans to jointly participate in. This was accomplished using new computer hardware that was purchased with Sparks funds. The zoo's research and education staff helped to create a weekly event in which a group of guests were randomly chosen to play a short computer game with an orangutan participant. These sessions were highly successful. A total of eight sessions were given, occurring on Monday afternoons starting in August and continuing to the present. For each session, a single orangutan was given the opportunity to voluntarily enter the learning studio to participate in the computer game. If the orangutan accepted the invitation, a group of zoo guests was then randomly chosen by educational staff, and invited to participate in a fun and engaging new exhibit experience. Sessions lasted for fifteen minutes and consisted of a virtual ping pong game in which the orangutan and human participant bounced a virtual ball back and forth between to interconnected touch-panel screens (Figure 2). The orangutan was given food rewards via an automated food dispenser after bouncing the ball three consecutive times. While the limited duration of the Sparks project precluded the possibility of conducting a robust empirical study to survey the guests about their experience, we can anecdotally report that the guests described the experience as enjoyable and informative about the intelligence of orangutans. The zoo is planning to increase the frequency of the guest/orangutan computer interaction sessions, and to design a future survey study to gauge the guest experience using statistical methods.

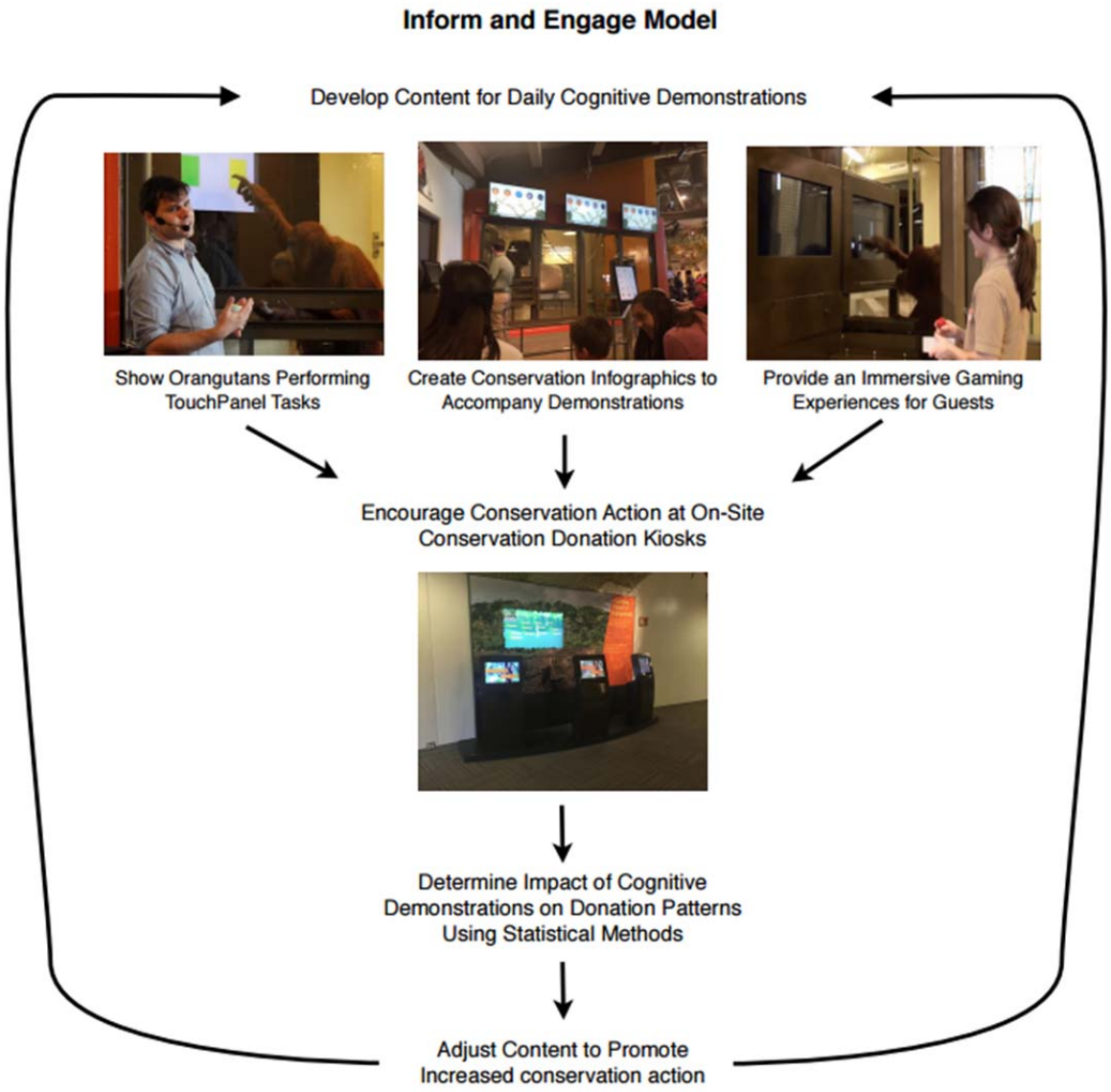
## 4. Challenges and Opportunities

The main challenge we encountered was completing the project in the one year of allotted time. The procurement of new equipment and exhibit content took up a substantial portion of the year, leaving relatively little time to deploy it and test its impact. For example, the infographic animation was completed by month 8 of the project, which left 4 months for designing a suitable statistical study to examine the impact of the video on zoo visitors' conservation engagement levels. As a result, the study we conducted had a smaller sample size of days than would have been ideal for achieving robust statistical power. However, in thinking of the work we did as a pilot for future efforts at gauging the impact of cognitive demonstrations on donation patterns, the project was highly successful. Moreover, we believe that the model that was developed, which we call "Inform and Engage" (shown in Figure 6), provides a very useful framework for developing exhibit content aimed at increasing conservation awareness and action.

As a platform for demonstrating the intelligence of orangutans to zoo guests, touch-panel tasks are ideally suited toward fulfilling a range of educational and conservation oriented undertakings at the zoo. In particular, the novel shared computer task we developed for guests and orangutans

to play together was a valuable tool for engaging guests in an immersive educational activity. Given how such tasks were voluntary to orangutans, and provided a degree of enrichment to them, the development of the shared- task platform proved to be a win-win for guests and orangutans.

**Figure 6. Overview of the "Inform and Engage Model" developed for this project.**




In conclusion, the new exhibit features developed for this project provided a framework for empowering zoo guests to learn about orangutans, engage with them, and take conservation action to support their species survival in the wild. Moreover, it is our hope that the *Inform and Engage Model* might serve as a replicable methodology across zoos for leveraging public demonstrations of animal intelligence to promote conservation awareness and action.