WILD MINDS

What Animals Really Think

New York Hall of Science

Concept Design Report

Jeff Kennedy Associates, Inc.
June 30, 2010

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Introduction

This report briefly describes the Concept Design phase of work undertaken over the past seven months for the national traveling exhibition, *Wild Minds: What Animals Really Think*. The 1,500–2,000 square foot exhibition is the centerpiece of a project funded by a grant from the National Science Foundation and is being developed under the leadership of PI Martin Weiss, New York Hall of Science (NYHS), and Co-PI's Diana Reiss, Professor and Co-founder of the Animal Behavior & Conservation Concentration, Department of Psychology, Hunter College of CUNY, and John Fraser, Director, Institute for Learning Innovation (ILI), New York.

Planning for the project has involved the close collaboration with its organizational partners, the science centers and zoos paired to present complementary elements of the exhibition at each of the exhibition's venues: Chuck Kopczak, California ScienCenter/ Estelle Sandhaus, Santa Barbara Zoo; Marilyn Johnson, Oregon Museum of Science & Industry/David Shepherdson and Charis Henrie, Oregon Zoo; Kate Storm, COSI Columbus/Barbara Revard, Columbus Zoo; Martin Fisher, Science Central/ Jim Anderson, Fort Wayne Children's Zoo; and NYHS's zoo partner, Ella Viola, Staten Island Zoo. The project team's work has also been informed by its science advisors Frans deWaal, Emory University; James Gould, Princeton University; Irene Pepperberg, Harvard University; Rachel Severson, University of Washington; and Steve Zawistowski, ASPCA.

Jeff Kennedy Associates, Inc. (JKA) has primary responsibility for the team's exhibition development and design efforts, and would like to acknowledge the important contributions of colleagues Beverly Serrell, Serrell & Associates, who led the core team through a Big Idea workshop early in the process and facilitated the meeting of science advisors which provided the examples of cognitive abilities and research case studies upon which exhibit elements will be based; Maria Maust-Mohl and Rachel Morrison, both of Hunter College of CUNY and ILI, who participated in content development and in the testing and evaluation of exhibit prototypes installed at NYHS earlier this month; Ellen Guisti, external evaluator who is studying the team process as well as the measurable outcomes of project deliverables; and Tara Chudoba, NYHS Exhibition Project Manager & Education Specialist, whose role as a communications hub and organizational linchpin have made the meetings of our far-flung team work smoothly.

The Concept Design phase of work lays the foundation for design decisions that follow in subsequent phases of project development. A key task of this phase has been a Front-End Evaluation of public perceptions of animal cognition, in order to survey and understand audiences at the wide variety of venues at which the traveling exhibition will be presented, with particular attention to designing the exhibit for maximum interest and appeal to those audiences. The other fundamental issues addressed by the Concept Plan are the development of the exhibition's organizing framework and interpretive strategy. However, the inclusion or exclusion of individual exhibit components and their spatial location in the floor plan will be addressed in the next phase of work, Design Development, after the essential direction-setting decisions discussed in the Concept Design report have been agreed upon by the team.

Overview

The exhibition will focus on how, through research, new knowledge of animal cognition has resulted in an increased awareness of the cognitive abilities other animals share with our own species. The nature of recent and ongoing animal cognition research challenges established boundaries in science, such as psychology, neuroscience, physiology, anthropology, sociology, evolutionary biology, and ecology. Case studies of research projects observing and investigating the behaviors of a wide range of animals, in the wild and in laboratory settings, can provide impressive, intriguing and often surprising entry points for engaging visitors of all ages in thinking about animal cognition.

Target Audiences

The exhibition is being developed and designed to appeal to families with children, the majority of visitors to science centers and zoos. At the project's November 2009 opening workshop, the organizational partners confirmed anecdotally that their visitor demographics are essentially the same, with visiting groups most typically consisting of 1–2 adults and one or more children in the 6–8 age range.

Front End Evaluation

In December 2009, ILI conducted a front end evaluation of public perceptions of animal cognition using two different modes of study: qualitative interviews with NYHS and Staten Island Zoo visitors and a quantitative online survey of adults (18 and older, recruited by a marketing firm) likely to visit a science center or zoo. The results of the former were used to develop questions for the latter.

The study results suggested that people believe animals think, but that they don't have strong opinions about how they think, nor is there a prevailing narrative associated with systematically considering how one might know animals think. The general neutrality of responses was described by ILI/Hunter College as indicating that science center and zoo visitors will be open to learning about the topic of animal cognition. Findings also suggested that participants were more likely to attribute cognitive abilities to wild animals, dogs and cats, and higher mammals, but not to farm animals, and that the survival-based abilities participants attributed to animals were not necessarily associated by them with thought processes in those animals. Numerosity and self awareness were identified as two types of learning visitors would be interested in seeing represented in the exhibition.

Main Messages

The project's opening workshop involved the core team in exercises designed to arrive at consensus on a 'big idea' that could serve as a useful filter in developing exhibit experiences. Beverly Serrell facilitated a 2-phase session in which a preliminary, collectively-constructed big idea sentence resulted: *Recently discovered (shared) cognitive abilities that have evolved in non-human animals show the connections between us*.

The team revisited this big idea as part of its second team workshop, after a session in which we heard recommendations from the project's science advisors for the most relevant and important research case studies from which to draw exhibition content (see Developing a Content Framework, below), and as a further filter for developing meaningful visitor experiences, agreed on the following list of main messages the exhibition will convey:

1. We are part of a world filled with thinking creatures.
2. Animals think in a variety of ways to address challenges they face in life.
3. Some of these ways are similar and some are different.
4. Through careful observation, we can see the kinds of complex thinking that happens in the animal world.
5. Knowing we share thinking processes with other animals helps us empathize with them.

As experiences are developed and refined during the design process, care will be taken to ensure that these main messages are underscored from component to component and reinforced in the language used in exhibit label text and graphics.

Developing a Content Framework

Project Co-PI's Diana Reiss and John Fraser, supported by Hunter College graduate students in Dr. Reiss' Department of Psychology's Animal Behavior & Conservation concentration Maria Maust-Mohl and Rachel Morrison, undertook a literature review prior to the February 2010 team meeting its with science advisors. Using topics identified in that review as a basis for stimulating discussion, each of the science advisors was asked to present synopses of a range of case studies that they felt would best represent important research into key aspects of animal cognition. Analysis of the material presented at this meeting directly led to the creation of a document delineating key concepts, terms and categories for understanding animal cognition, for use by the exhibition development team.

Key concepts/terms for understanding animal thinking included physical continuity, cognitive continuity and brain architecture; umwelt (defined as an organism or species' overall perception of their current surroundings and previous experience, unique to each organism); and continuity of thinking/genetics vs. versatility, which provided a framework for considering three different levels of cognition—
1. hardwired,
2. some flexibility in thinking, and
3. complex or highly adaptive thinking.

The paper went on to define broad categories of animal cognition that could provide the basis of a conceptual framework for the exhibition. These broad categories—Culture, Food and Predation—were then each discussed on three different levels of cognitive activity, with research studies provided that matched those levels. Whether undertaken in a lab, or in the wild, each case study cited is a story providing one small window into the myriad ways animals think.

The three broad categories underlying the content framework were then further divided into sub-categories:

- concept formation
- representation of space, time and number
- numerosity
- tool use
- building and making
- communication
- self-awareness, self-abstraction, empathy and deception
- creativity and play.

This content framework, and the concepts explored in the specific case studies cited as examples relevant to each sub-category, will provide the foundation of the exhibition's conceptual organization.

Evaluating the Use of Video as a Primary Element in Exhibit Experiences

With the content framework and case study recommendations in place, JKA did some initial thinking about visitor experience/interpretation challenges inherent in the exhibition. While a well accepted planning/design axiom is that every exhibition should be imbued with a broad range of experiences (hands-on elements, interactive multimedia, authentic object display, full-body activity, etc.), some exhibitions necessarily lean more heavily toward more of one experience type than the "general" experience mix. Video of animal behavior in the wild and in lab-based controlled experiments is the prevailing medium of documentation used by researchers both to record their work and to make it accessible to lay audiences. Linear, narrative video (as seen in NOVA, National Geographic or Animal Planet programming), does not typically attract and engage visitors in science center exhibitions.

The evaluation question JKA proposed for investigation was: could video segments be presented in ways that gave visitors an active role, rather than putting them in the role of passive viewers? Moreover, in a mini exhibit of five components, all media based, would visitors remain engaged or be put off by too much video?

One reason for investigating this early in the design process was that, if visitors were not effectively engaged, we would know we had serious challenge on our hands sooner rather than later. The second reason, however, assumed that we would have some measure of success, and that through strategic development of different approaches to multimedia prototypes, could learn something about why visitors prefer certain approaches over others. A third and final reason was that working with the team's PI's and advisors to obtain video source material (at least in some instances), and developing draft scripts and label text, would provide everyone with a first glimpse into what it takes to develop an exhibit component. Even if our inquiry resulted in a negative response, there would no doubt be some use of multimedia in the exhibition, so this first experience developing multimedia would not be without value for the team.

Development and Evaluation of Multimedia Prototypes

Our assumption was that, in order for visitors to be able to make sense of experiments or observational studies investigating animal cognition, we needed to provide a narrative that poses the research question (in lay terms), explains the research set-up, and interprets the animal behavior (perhaps only after visitors make their own observations/conclusions). In other words, the exhibition must contextualize each story. For the exhibit design team, this implied the need for some form of multimedia engagement. Even if the contextualization is broken up into part photos/text, part object related to the study, part video, the high-engagement element would be the video.

We developed five components ranging in levels of interactivity, from straight video to be viewed passively (Alex the Parrot demonstrating his ability to count; dolphins creating bubble rings as objects of play) to multimedia asking visitors to do their own thought experiments before watching footage of the animals undertaking to solve the same problems (Betty the Crow making a hooked tool out of a straight wire in order to retrieve a piece of meat in a basket hanging inside a tube; orangutans and chimps using water to float a peanut out of a tube), to a short term memory test visitors could take themselves, repeatedly, then guess the speed at which a chimpanzee could successfully complete the test.

Two of the five components presented, along with a strong story told on video, an interesting object connected with the study in question: the video showing the counting demonstration by the African gray parrot, Alex, conducted by Irene Pepperberg, was accompanied by a replica of the tray of objects of various sizes, shapes and colors used to reveal his ability to count; a multimedia piece incorporating video of a problem solving experiment with Betty, a New Caledonian crow, in an Oxford lab, was accompanied by a physical display of objects similar to those used in the experiment.

In mid June 2010, a suite of five prototype components for testing was installed at NYHS in order to see if visitors would be put off by, and therefore choose not to engage (or engage minimally) with, a set of components all relying on video as the primary medium of interpretations/interaction, and to evaluate the attracting power and engagement levels of five different approaches to incorporating video into exhibit experiences. All five components presented case studies of research undertaken with charismatic animals exhibiting highly adaptive thinking. An advance organizer graphic panel was created to serve as an exhibit entrance marker.

ILI/Hunter College conducted a formative evaluation of this installation over two weekend days, recruiting families with children to visit the exhibit. Visitors were invited to spend as much or as little time as they liked and were told that there was no specific order in which to explore the components. ILI used a mixed methods approach to evaluation, utilizing both observations and interviews to assess levels of engagement and reactions to the components presented. JKA also provided a list of specific questions related to each of the components, aimed at understanding whether the activities stimulated conversation, encouraged

collaborative learning, or had special appeal because of the animal species showcased rather than the mode of interaction.

Their study found that visitors had a high capacity to watch and learn from video, and that even the component that was simply a straight, passively-viewed 3-minute video was able to attract and hold the attention of both children and parents – a finding the evaluators posit may be due to the nature of the behavior it presents, play. Overall, the installation was very positively received by visitors, with the majority of families spending from 14 to 25 minutes and engaging with all five components without showing signs of fatigue; families that did not interact with all five components stayed between 8 and 13 minutes. As anticipated, the component with the highest degree of interactivity (the short term memory test) was the most popular with visitors of all ages. The findings also showed that certain activities were more successful in terms of encouraging collaborative learning than others, others more likely to set up a humans vs. other animals competition, which is not an intention of the exhibit design team.

The ILI report also describes findings beyond the primary inquiry related to video approaches, including visitors' conceptual understanding of the components, developmental growth and age appropriateness of the components, and ergonomics of equipment, programs and gaming. The exhibit design team will take these findings into consideration when taking component design to the next level.

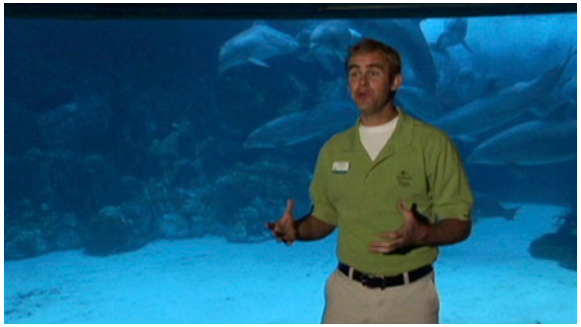
The report noted that several of the species selected for inclusion in the prototype components were those visitors expressed familiarity with as animals capable of highly adaptive thinking (dolphins, chimps and orangutans in particular). In Design Development, care will be taken to develop exhibit experiences featuring animals of all levels of cognitive ability, in order to broaden the exhibition's focus and inspire visitors to make connections to the exhibition's big idea and main messages.

Components Prototyped and Evaluated

Exhibit entry panel, prototyping session

1. Dolphin Bubble Play

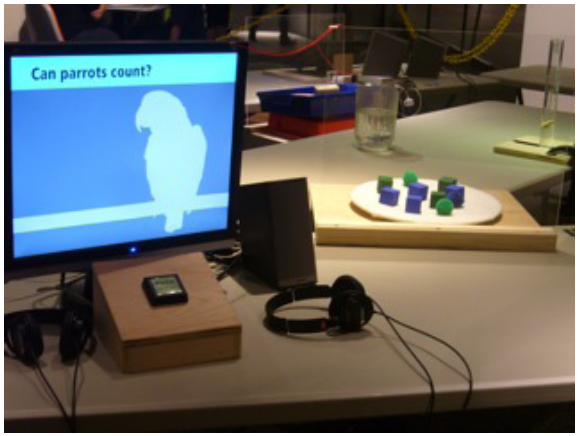
- Dolphins shown creating bubble rings and playing with them.
- Commentary by Sea World scienctists, staff and visitors
- No visitor interactivity; straight video plays on demand (approximately 3 minutes).



prototype video

2. Alex the Parrot, Counting Demonstration

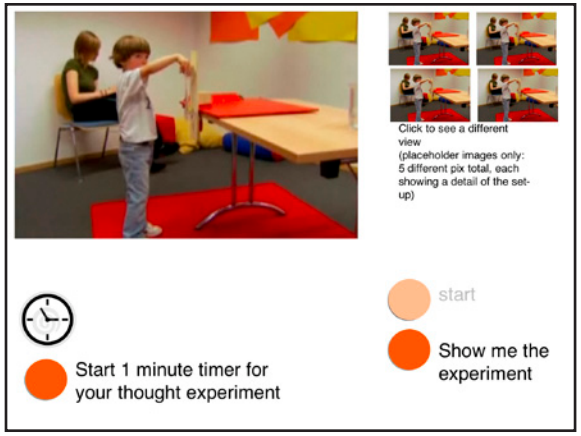
- Alex shown undertaking cognitive challenges with research scientist Irene Pepperberg, who comments on camera.
- No visitor interactivity; straight video plays on demand (approximately 3 minutes).
- Incorporates a physical replica of the experiment apparatus displayed next to the video monitor; the video makes no direct reference to the apparatus and there is no challenge for the visitor.

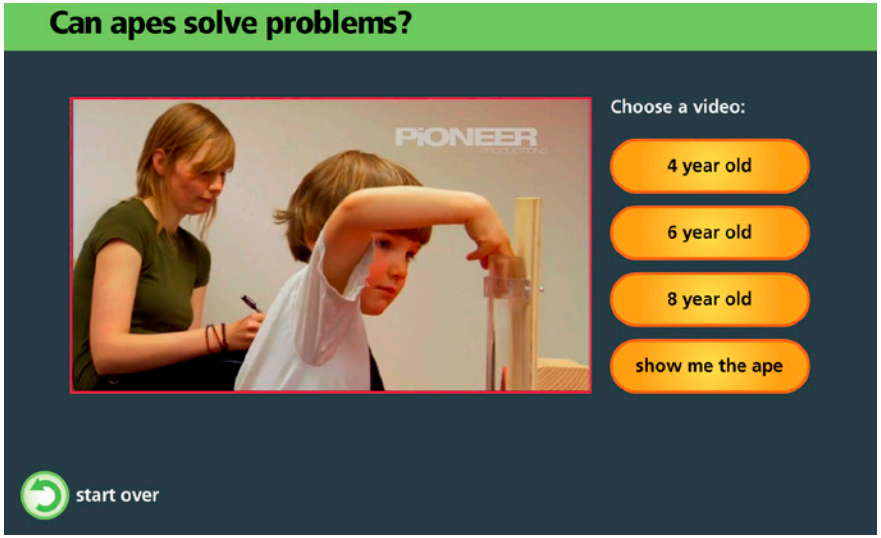


video stills from prototyping

3. Getting the Peanut Problem: Humans ages 4, 6, 10; orangutans & chimp

- Before viewing children and apes take this challenge, the visitor is invited to try it as a thought experiment (the test subjects all have the advantage of being able to manipulate the apparatus, and examine it in great detail).
- In this case, rather than having physical replica of the test, after having the challenge explained in the first part of the video, visitors can start a 1-minute timer and examine 3 different pictures of the test apparatus in order to arrive at a moment of insight.
- After this interval (which visitors can extend by another minute), visitors then can then choose to see one or more clips of how children of three different ages solved (or failed to solve) the problem, and how apes (orangutans followed by a chimpanzee) solved the problem. Voice over explains the details of the experiment and the nature of the cognition involved.

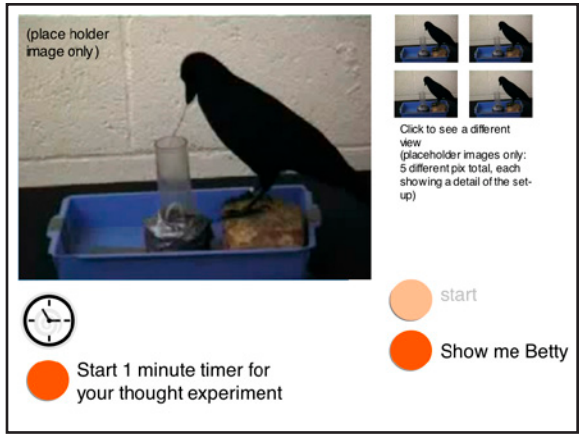


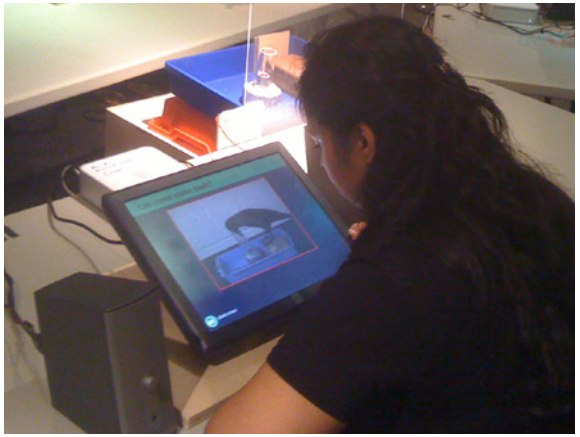


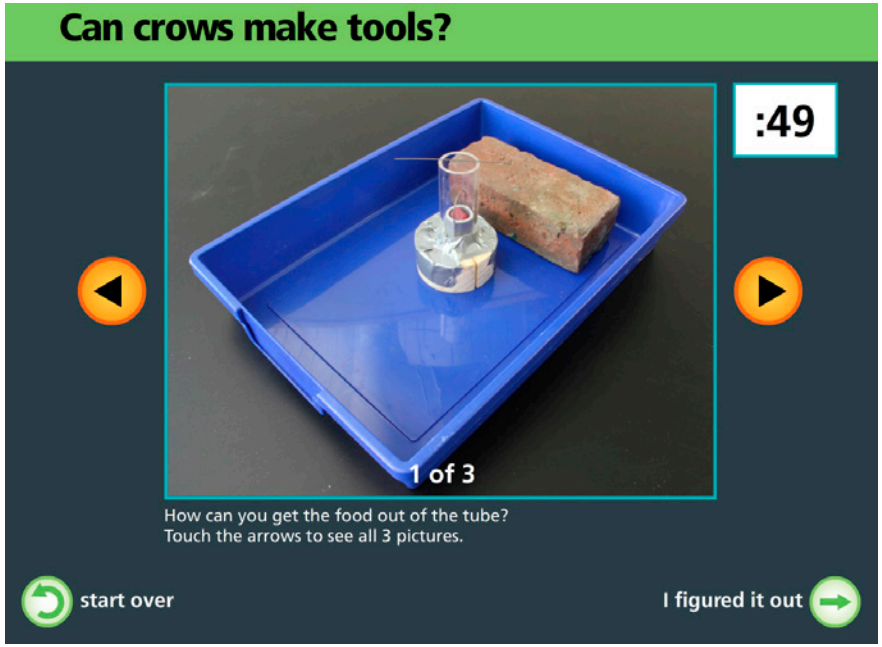
prototype software

4. Getting the Meat Problem: Betty the Crow

- The video begins by posing a thought experiment to visitors—a challenge identical to the one given to Betty the Crow: how can you get a piece of meat (lodged in a small basket) out of a tube, using only the materials you see in front of you (there is a straight piece of wire on the table next to the tube)?
- After introducing the thought experiment, visitors start a 1-minute timer, taking time to think and to examine a replica of the apparatus with which the crow interacted.
- After the pause (which visitors can choose to extend by another minute), visitors then see a clip of how Betty solved the problem; a voice over explains details of the experiment and the nature of the cognition involved.



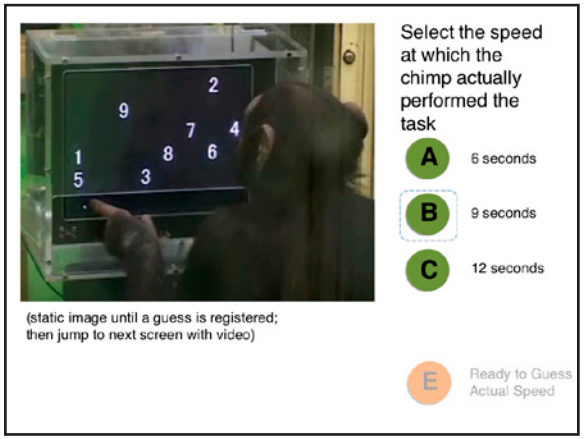


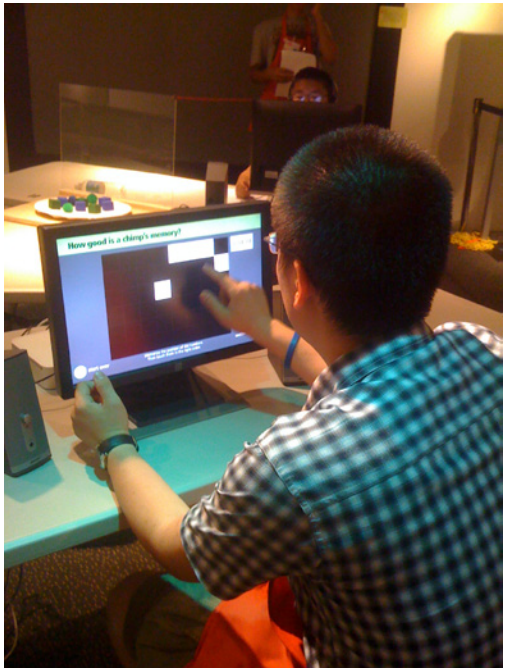


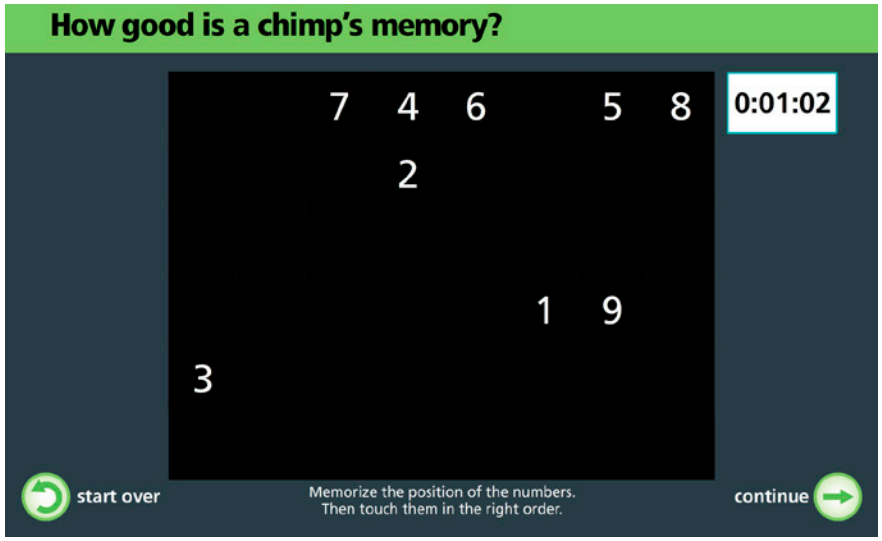
prototype software

5. Chimp Memory Test

- This is a combined video and computer-based component that allows visitors to take the same memory test as a chimp – memorizing and then touching, in numerical order, the digits 1-9 displayed on the screen. This is the most highly interactive of all components prototyped.
- Visitors begin by watching a video that sets up the experiment, seeing a chimp performing the challenge.
- To enhance engagement, visitors get a chance to see the chimp doing the test at three different speeds. They are then asked to select the speed at which they believe the chimp actually performed the task. After making their guess, visitors then see the correct answer – the fastest speed.
- After this sequence, visitors are asked if they want to try the test themselves. If the test proves too difficult, they can reduce the sequence of numbers they must remember down from 9 to 7, and then down to 5.







prototype software

Conclusions and Next Steps

Informed by the findings of the formative evaluation by ILI, the exhibit design team is confident that an approach relying on video as the primary medium of interpretations/ interaction can succeed with our target audience, families with young children.

Early in the next phase of work, Design Development, we will explore the possibility of using other approaches as we seek to include components based on research into hardwired and moderately flexible cognition in other species recommended by our science advisors.

The team will also consider the development of a second round of formative evaluation, creating a mix of prototypes and interpretive graphics designed to convey the exhibition's main messages.