Using Evaluation to Develop a Wayfinding System

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Studies on wayfinding design show that evaluation has been used to improve elements of existing signage or to compare different combinations of wayfinding aids. Much less frequently have such studies reported on how formative evaluation was used to revise a wayfinding system completely.

At the Adler Planetarium & Astronomy Museum in Chicago, visitor data from extensive formative evaluation was used to guide decisionmaking on design revisions for a wayfinding system. Our design consultant fabricated inexpensive, laser-printed wall maps and directional sign prototypes that we placed throughout the building. These prototypes allowed us to make changes quickly and cheaply, so that we could test different versions of the signage systematically with visitors.

For this project our goal was to make a signage system that could help visitors navigate through our building quickly and easily. We held the assumption that if visitors could not figure out how to get somewhere, the signage design was at fault, rather than the visitor. Another important assumption we held was that no matter how talented and experienced the museum's team members were, it would be impossible for us to create an effective wayfinding system without feedback from visitors in the environment where the signage would be used.

The series of evaluations we devised were an attempt to break down wayfinding behavior into its component activities. In *Wayfinding: People, Signs and Architecture*, Paul Arthur and Romedi Passini (1992) refer to wayfinding as a "continuous problem solving process." The success of each wayfinding step depends on the success of the one before it, and these steps must be solved in a particular order. Therefore, we decided to conduct a series of evaluation studies based on the mental and physical steps that people go through to solve a wayfinding problem. We identified and tested component activities of the wayfinding process one by one, and built up the system incrementally.

Five in-house reports from these formative studies, plus a summative study assessing the final signage after installation, document this iterative process of development. In addition, a summary report discusses the overall process of evaluation in the development of Adler's wayfinding system: describing the intention of the studies, major findings, and implications of evaluation on signage development. All of these studies are available upon request.

Reference

Arthur, Paul and Romedi Passini. 1992. *Wayfinding: people, signs, and architecture*. Whitby, Ontario: McGraw-Hill Ryerson Ltd. 27-33.

How "Down to Earth" Is the Universe?

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A New Building for Adler's Visitors

In 1997, the Adler Planetarium and Astronomy Museum will break ground for a new building addition that will add significantly to the museum's physical presence on Chicago's lakefront. Together, the new and renovated buildings will contain approximately 40,000 square feet of exhibit space. The new wing, made almost entirely of glass, will provide visitors with an unequaled view of the day and night skies, as well as of Lake Michigan. In conjunction with this new construction the existing historic landmark 1930s building will be renovated, and a new Star Rider theater installed, featuring the latest digital sky-show technologies.

The Adler's addition is slated to open to the public in the summer of 1998, and with it will open three new galleries currently under development. The third gallery will open in spring 1999. These three galleries are the first of nine new exhibits that together will present astronomy content phenomenologically and in its historical and human context. In the broadest sense the goal of these three initial exhibits is to introduce visitors to our universe: defining its "realms" (Earth, solar system, Milky Way Galaxy, universe) and explicating the relationships and scales among the realms.

Working titles and main communication goals for these three galleries are:

> ***Cosmic Sky***: The universe can be pictured as objects in motion within four realms that you can see from Earth and interpreted using a few basic concepts.
>
> ***Solar System***: We live in the solar system, an active collection of many different worlds, all moving around the Sun and held together by gravity.
>
> ***Stars & Our Milky Way Galaxy***: From Earth we can observe our vast galaxy—the Milky Way—and begin to find what's out there, how it forms, and how it works.

The ***Cosmic Sky*** gallery will be the introductory experience for visitors to the museum, and the first exhibit they encounter after purchasing tickets. It will begin as a space immersion that, by way of special effects, dramatically suspends the visitor between Earth and the stars. This affective experience will encourage visitors to think about the ways that the universe has inspired both professional and amateur astronomers. A short theater experience (making use of the planetarium's Zeiss star projector) will introduce visitors to what they are able to see of the universe from here on Earth, and a series of models will help visitors develop a mental map of the universe's scale and structure. "How do we know all this?" is the question addressed in the last

portion of the gallery. Concepts of gravity, motion, light, and energy are introduced to help answer this question. These concepts will be reinforced in each gallery as they apply to that exhibit's content.

The ***Solar System*** gallery will present the idea that our solar system is much more than nine planets orbiting the Sun. Visitors will be introduced to a collection of more than seventy "worlds"—planets, moons, asteroids, and comets—that can be best understood in terms of the physical and "behavioral" patterns they display. With interactive exhibits, visitors will engage in the science of "comparative planetology" and explore why some worlds have weather, discover what makes the most massive planets resemble mini-solar systems, and take simulated multi-sensory trips to Venus and other remarkable places among the worlds of our solar system.

The ***Stars and Our Milky Way Galaxy*** exhibit will introduce visitors to our galaxy: what it looks like, what's in it, and how we know these things. An immersive multimedia environment will take visitors on a trip through our galaxy and set the stage for the exhibit. A large section will cover the stages in the lifecycle of stars and explain how gravity, motion, and energy affect what happens to stars. Other exhibits will let visitors explore how light brings us information about the galaxy. Visitors will be able to access real-time images from actual remote telescopes. An image gallery and demonstration space will use multimedia components to present up-to-the-minute astronomy developments.

Front-End Evaluation Informs the Process

Each exhibit team includes an evaluator whose initial role has been to guide formulation of the exhibit's main idea and key goals. Front-end evaluation with visitors has necessarily informed that process, especially because exhibit developers and evaluators have not found much published research in informal education environments that examines how people think about astronomy. Exhibit planners knew how *astronomer's* "picture" the universe, but they did not have any information on what a *visitor's* picture would look like. Therefore, evaluators placed more emphasis on investigating visitors' thought processes—how they make sense of astronomy topics cognitively and affectively—than on their command of specific facts.

Exhibit evaluators decided to begin with the broadest, most open-ended investigations into visitors' conceptions of the universe. Two in-house studies (Picture the Universe and Sort the Universe) were short, open-ended interviews with a small sample of Adler visitors. Two subsequent studies (About Stars and Solar System Worlds) were also open-ended interviews that were targeted to explore content that was specific to particular galleries. In addition, a series of eight focus-group studies was conducted by an outside marketing firm to explore astronomy attitudes and conceptions and also to get feedback on specific exhibit ideas for the three galleries that had been developed thus far.

Data from the four in-house studies were intended to work together to provide an aggregate picture of how visitors conceive of the universe and everything in it. The data from these studies has guided exhibit developers in their thinking about how to present exhibit content: confirming the appropriateness of planned approaches or pointing to new avenues for communication; bringing out where visitors' thinking incorporated misconceptions; identifying areas where visitors felt confident or uncomfortable; and highlighting areas where visitors' understanding of astronomy could be enhanced.

Picture the Universe (n=25 adults; 15 children)

The first study was conducted to:

- determine how visitors conceive of the universe;
- identify any particular frameworks or reference point(s) in visitors' mental map of the universe;
- see if and how visitors' framework matched that of exhibit planners; and
- gauge visitors' familiarity with various objects in the universe.

Visitors were given labeled color laser prints of celestial objects (see Table 1), and they were asked to arrange these on a large sheet of paper to create a picture of the universe. Once they had completed this activity, visitors were asked to explain how the picture was arranged and how it illustrated their conception of the universe and the relationships among the things in it. Evaluators probed visitors for information about where they placed images in relation to each other and why they grouped some items together. The evaluator drew lines and circles directly on the paper among the images to illustrate connections and groupings that visitors described and also wrote verbatim notes on what visitors said about their picture.

Table 1
Images used for "Picture the Universe" study

Clouds	Moon	Airplane Hubble	Space Telescope	Space Shuttle
Sun	Meteorite	Space probe	Meteor shower	Jupiter
Asteroid	Mars	Earth	Comet	Black hole
Orion nebula	Pulsar	Stars	Pleiades star cluster	Star—Betelgeuse
Galaxies	Supernova	Quasar	Globular star cluster	Andromeda galaxy
Dark matter	Virgo galaxy	Whirlpool galaxy		

Sort the Universe (n=16 adults; 16 children)

The second study took this image-sort activity one step further to test the viability of the specific framework of four universe "realms." This slightly more directed evaluation was conducted to:

- see how familiar visitors were with where objects "belonged" (*i.e.*, a black hole does not "belong" in the solar system, but can belong in the Milky Way Galaxy); and
- gauge visitors' familiarity with various objects in space.

For this study visitors were given the same images as in "Picturing the Universe," but this time the paper was marked with the four realms "Near Earth," "Solar System," "Milky Way," and "Rest of Universe." As before, visitors were asked to explain why they had sorted the images as they did, and evaluators recorded their comments verbatim.

About Stars (n=30 adults; 20 children)

The third study addressed specific content from the ***Stars and Our Milky Way Galaxy*** exhibit, specifically that different star types illustrate a stellar evolutionary sequence. The purpose of this study was to:

- find out generally how visitors "perceive" stars;
- see what visitors know about stars: what they are, what they are made of, and what they do; and
- gauge familiarity with star types, variation, and through the cycle of changes that stars go through.

Visitors were asked to describe a star, then were given labeled laser printed images (Table 2), and they were asked to sort these images into groups on a piece of paper marked, "related to stars," "not related to stars," and "don't know/not sure." Visitors were then asked to say why they had put certain images in the stars group, and what the things in the stars group had to do with each other.

Solar System Worlds (n=25 adults; 25 children)

The fourth front-end study was designed to reveal:

- how people describe position and motion within the solar system
- specific information visitors have about individual worlds in the Solar system

Visitors were asked what keeps the Sun and planets in space and how the arrangement of worlds in the solar system might change over the course of six months and what would have caused that change. Next, the interviewer showed visitors a series of cards containing the names of planets, moons, an asteroid, and a comet (see Table 3 below), and asked which names were familiar. Visitors were then asked to describe or identify the worlds they had heard of, and these comments were recorded verbatim. Lastly, visitors were asked which of the solar system worlds could support life.

Gallery Focus Groups (n= 4 to 12 subjects per group).

Focus groups were conducted with eight sets of visitors representing different demographic characteristics, including two groups of children. The purpose of the focus groups was to:

- learn about peoples' response to astronomy;
- learn how they react to different types of exhibit experiences (especially hands-on interactive exhibits); and
- get feedback on specific exhibit ideas for each of the three new galleries.

Six groups of adults (one group of recent Adler visitors with children, one group of recent Adler visitors without children, two groups of museum-goers with children and two groups of museum-goers without children) and two groups of children (third graders and fifth graders) participated in the focus group discussions.

Messages from the Front-End Evaluation

These findings are compiled from all of the front-end studies conducted thus far.

Data indicated visitors **don't** know:

- much about astronomy (or *think* they don't know much)
- how to identify non-planetary worlds of the solar system
- as much about astronomical items in the realms furthest from Earth, nor do they have as much confidence in their knowledge of those "faraway" realms

Data indicated visitors **do** know:

- the Sun is a star
- galaxies are composed of stars
- that Earth completes half of its orbit around the Sun in the course of six months and that gravity has something to do with motion in the solar system
- which kinds of astronomical items belong in "Near Earth" and solar system realms; many adults also know which kinds of astronomical items belong in Milky Way and "Rest of Universe" realms
- that stars change over time in an evolutionary sequence ("life-cycle")
- planets in the solar system and their general order from the Sun.

Table 2
Images used for "About Stars" study

Pulsar	Nebula	Red giant	White dwarves	Brown dwarf	Quasar
Sun	Meteors	Galaxy	Asteroid	Jupiter	Supernova
Clouds	Moon	Earth	Comet	Black hole	Dark matter

Table 3
Names of worlds used for "Solar System Worlds" study

Earth	Europa	Halley	da	Io	Jupiter	Mars
Mercury	Moon	Neptune	Pluto	Saturn	Titan	Triton
Uranus	Venus					

Data indicated visitors **thought** about the universe in some of these ways:

- people conceive of the universe in terms of what's closer and what's farther away
- less familiar things are assumed to be farther away
- in "Picturing the Universe" most people spontaneously created an "Earth Stuff" category, some created a "Solar System" or "Planets" category, but almost none created either a "Milky Way" or "Universe" category
- the Sun is the most common reference point or starting point for people creating a picture of the universe and is considered the "center" of something, *e.g.*, center of the solar system or the entire universe
- they can discuss stars in "scientific" or factual terms (what stars are made of and/or how they work)
- they think of stars in "experiential" terms (how they look or seem to us from here on Earth)

Data indicated visitors **want** these things in astronomy exhibits:

- "real" experiences, such as tangible objects (*e.g.*, Moon rocks), real images from space missions, real-time experiences with data, real pieces of technology that were used to explore space
- access to what is current and dynamic about astronomy
- interactive exhibits for both children and adults, especially high-tech, multi-sensory simulations or rides
- interpretation to help visitors make sense of real space images or data
- museum personnel on the floor to demonstrate and interpret exhibits

Implications for Exhibit Development

Findings from these front-end studies have helped exhibit teams think more carefully about what the planned exhibits can attempt to do, in light of Adler visitors' experience with astronomy topics and concepts. Specifically, developers would like to achieve the following outcomes for visitors who go through these exhibits:

- help visitors incorporate/integrate a realm-based conceptual framework into their view or mental map of the universe;
- help visitors gain confidence in their understanding of how the universe, the Milky Way Galaxy, and the solar system are structured and interrelated;
- help visitors expand their conceptions of both objects and realms (*e.g.*, the galaxy is not just made up of stars, but encompasses black holes, dust, etc.);
- give visitors an opportunity to "build" a model of the universe (and each realm) through exhibit interactives;
- give visitors ways to synthesize what they can see and experience of the night sky with what is really out there in the universe;
- give visitors examples of how what we can see tells us things about what we can't see (e.g., how we know what the shape of the Milky Way Galaxy is from our perspective on Earth, or, how we know where we are located in the solar system);
- expand visitors' understanding of the ways we explore the universe;
- provide opportunities for visitors to see how light, gravity, energy, and motion experienced here on Earth allow us to interpret what we see throughout the universe; and
- allow visitors to feel a part of the process of the evolution of human ideas about the cosmos.

With these aims in mind, the gallery teams have moved on to more clearly articulate exhibit section goals, key ideas, exhibit experiences, and cognitive and affective outcomes. As ideas for exhibit experiences gel, these will be tested in prototype form to determine how mental constructs about astronomy and our place in the universe can be made concrete, interactive, and engaging for casual visitors to the Adler's new galleries.

For more information, or to obtain detailed reports on the studies described in this article, please contact Britt Raphling, Evaluation Department, Adler Planetarium & Astronomy Museum, 1300 S. Lake Shore Drive, Chicago, IL 60605, 312/322-0510, braphlin@midway.uchicago.edu

ChanSpotting #3

He's been working for a "dream client" on an exhibit project in Green Bay, Wisconsin, that includes an outdoor trail system, a backpack self-guiding tour, and indoor interpretative materials, including an environmental problem-solving computer program.