

Life on the Edge

SUMMATIVE EVALUATION REPORT

By Sarah Cohn
Principal Consultant

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Aurora Consulting
2429 Nicollet Ave, Minneapolis, MN 55404
www.auroraconsult.com

“There is a good mix of levels of involvement. Both children of different ages and the adults are engaged by the exhibits. Younger kids can push buttons and build things, while older kids can read the signs and program the rover.”
~ Visitor feedback

INTRODUCTION

Life on the Edge is a traveling exhibition focused on educating children ages 8-14 and their families about how understanding Earth’s extreme environments helps us search for life in space. Created by Sciencenter in Ithaca, NY, the big idea of the exhibition is: “our exploration of extreme environments expands our understanding of life on Earth and the possibilities for life in our solar system and beyond.” Through five unique exhibit sections, the exhibition offers visitors information, activities, and questions focused on scientific exploration and discovery, life in space, and the origins of life on Earth.

The summative evaluation of *Life on the Edge* sought to understand the following:

1. How visitors use or experience the exhibition;
2. What visitors learn or take away from the exhibition; and
3. What impacts creating the exhibition had on the design team.

Gathering data at two different museums, Sciencenter in Ithaca, NY and spectrUM in Missoula, MT, the summative evaluation also captured the exhibition experience for different museums’ audiences. The following report describes the findings regarding each of these key questions.

Through observations and interviews, the evaluation found that the exhibition *Life on the Edge* successfully portrays the difficulties of defining and searching for life in environments not suitable for human habitation. The content and activities are well designed for children ages 8-14 while being a bit too advanced for children ages 4-7 to navigate on their own. Visitors reported enjoying *Life on the Edge*, and they appreciated the variety of activities and topics explored through the exhibits.

Evaluation Details

Aurora Consulting conducted the summative evaluation of *Life on the Edge*. Aurora's role as external evaluators is to serve as a bridge between the design team and their visitors. In this report, we describe the experience of *Life on the Edge* from the perspective of visitors. We provide interpretations of the findings that are reflective of the data and our experience in the evaluation of museum-based informal learning experiences. Evaluation activities are detailed in the appendix. Throughout this report, we provide interview quotes to illustrate each theme.

Over the course of 11 days, visitor groups were observed at Sciencenter and spectrUM as they entered the exhibition and explored the various components. 14 families were observed at Sciencenter and 30 were observed at spectrUM. Due to the ongoing impacts of the COVID-19 pandemic, fewer visitor groups were observed using the exhibition that the evaluation team had hoped to observe (See the limitations section for more information).

The first child to enter the exhibition was the primary focus of each observation. Evaluators tracked what components children stopped at for five seconds or more and sought to capture any conversations they overheard the visitor group having. When possible, evaluators tried to observe and track the activity of the adults and other children in the visitor group. This additional observation information is incorporated into the information presented here. As the visitor group was leaving *Life on the Edge*, evaluators approached an adult in the group and asked them to share their thoughts about the exhibition. Children in each group were invited into the interview once the data collector received permission from the adult. 34 groups were interviewed across both museums.

Evaluation Limitations

This evaluation has particular limitations, the greatest of which was the COVID-19 pandemic and its impacts on children's museums' visitor patterns. The target audience of 8–14-year-old children and their families had not yet returned to visiting museums at the time of this evaluation. At the Sciencenter, attendance of the target audience dropped significantly between 2019 and 2022.

- In 2019, visitor attendance was 107,000.

- In 2020, visitor attendance was 24,000 (22% of the last pre-COVID year)
- In 2021, visitor attendance was 40,000 (37% of the last pre-COVID year)

Much of the data collection occurred with families with children much younger than the target audience for *Life on the Edge*, impacting both how they interacted with the exhibition and how they engaged in the follow-up interview. These younger visitors appreciated and enjoyed the exhibition, but they did not engage in the content and ideas in the ways the team had hoped and expected older children would. More data should be gathered to more fully understand how 8–14-year-old youth are engaging with the material.

COVID-19 also limited the evaluation's findings by suppressing visitation patterns at participating museums overall. A pattern observed across the museum field, communities were not visiting museums or other indoor venues at the rates they did in 2019. At each site, evaluators were not able to observe or interview the target number of visitor groups during the data collection windows. The findings identified through this evaluation are thus limited by the sample size from which they were generated. To more fully understand the outcomes of *Life on the Edge* and how different communities respond to the exhibition, the Sciencenter should gather additional data from visitors at other museums on its tour.

VISITOR USE OF THE EXHIBITION

At each location, *Life on the Edge* components were arranged in different ways, and entrances to each exhibit gallery were located at different areas of the exhibition. See images 1 and 2 for each museum's exhibition layout.

Image 1: Sciencenter Layout of Life on the Edge

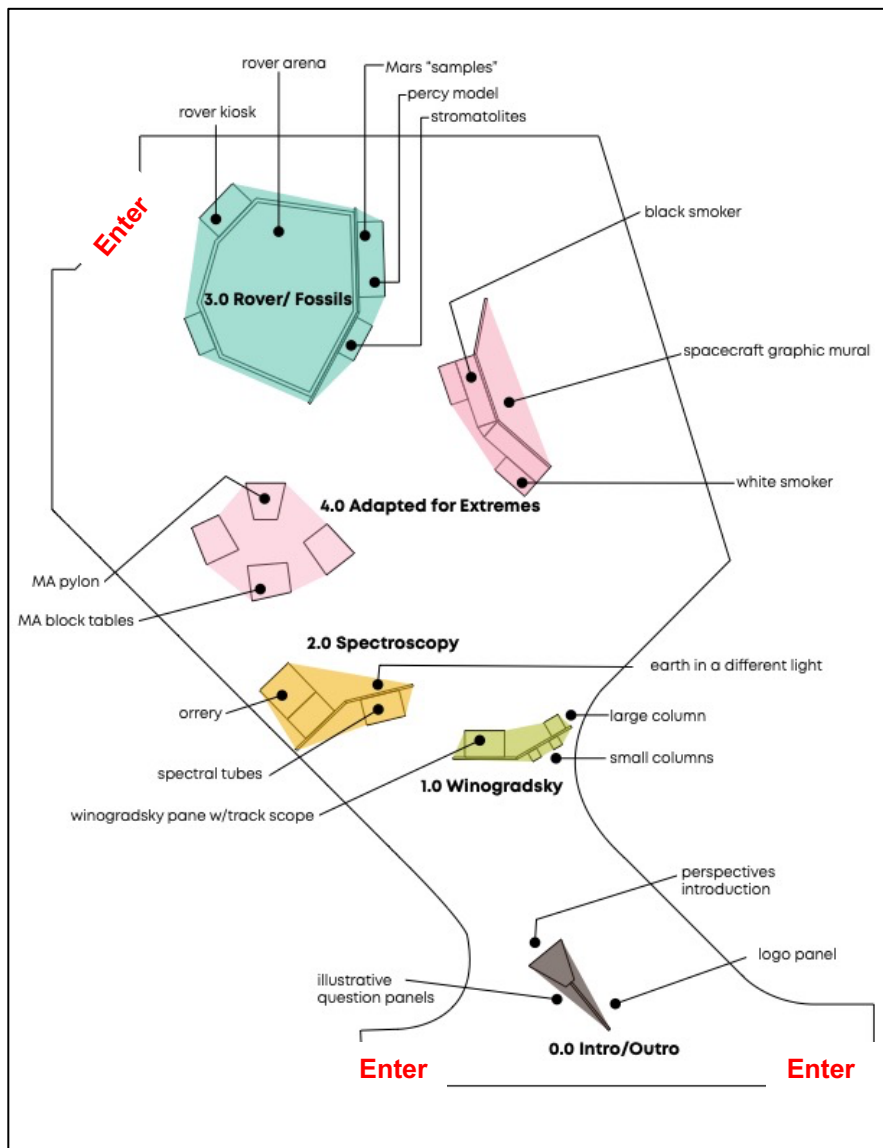
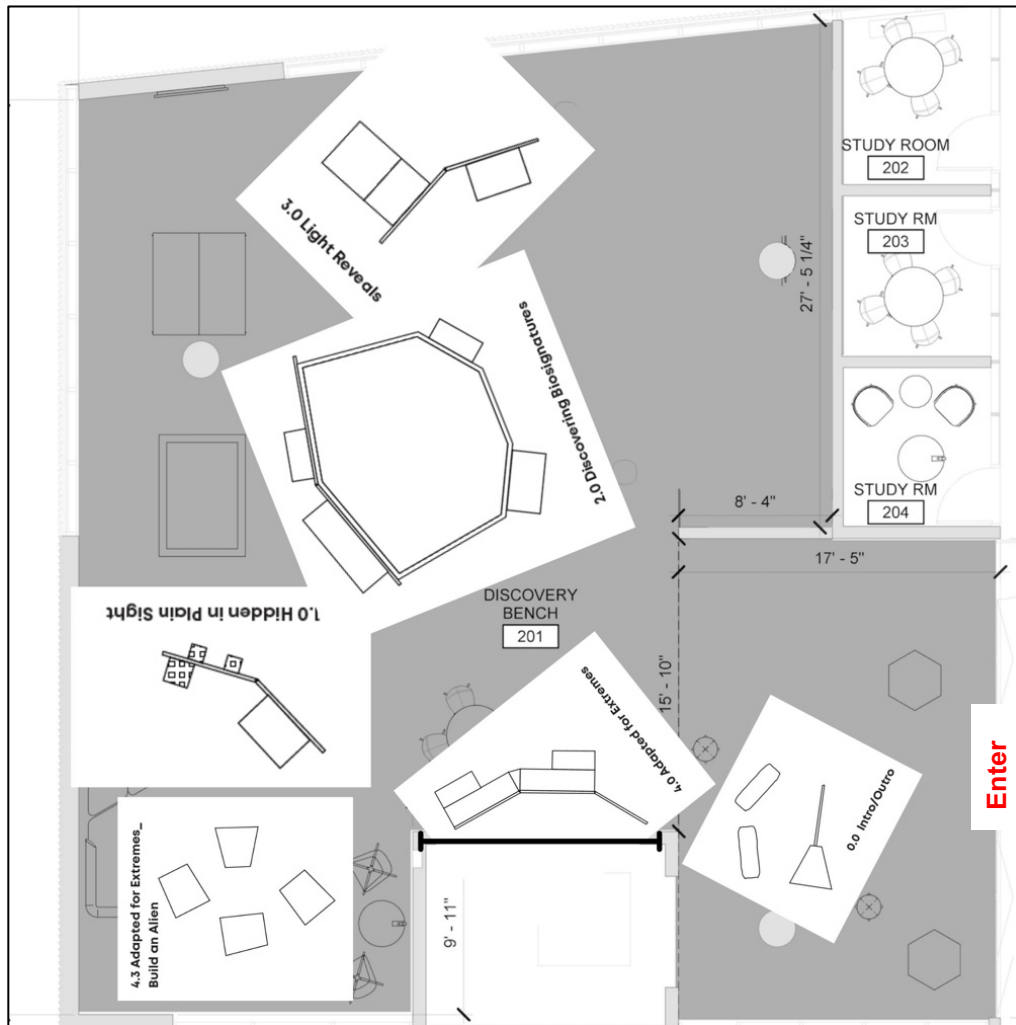


Image 2: spectrUM layout of Life on the Edge



Visitors spend the most time with the interactives.

Visitors were attracted to each exhibit area of *Life on the Edge*, stopping to look at the Ocean Vents or the Winogradsky columns, and playing with the different hands-on activities. Table 1 shows how many visitor groups stopped at or used each major exhibition component for more than 5 seconds.

Table 1: Visitor Use of Exhibits

	Sciencenter (n=14)	spectrUM (n=30)
Rover	14	18
Build an Alien	9	13
Ocean Vents	5	18
Orrery	5	11
Spectral Tubes	8	9
Track scope	4	8
Sample Microscopes	3	8
Winogradsky Columns	2	6
Rover Models	2	0
Europa	1	0

Visitors were observed spending between 5 seconds and 8 minutes at different exhibits, with the Rover and Build an Alien activities holding children’s attention the longest. While visitors were observed primarily stopping at interactive exhibits, observers did notice every exhibit component being skimmed or fully read as visitors moved through the space. The components that were read the least were the panels on the Intro/Outro stand.

Visitors moved freely throughout each gallery space, with some visitors looking at each component as they moved through the exhibition and other visitors walking or running directly to specific components. Each location had the elements of the exhibition arranged differently, and visiting groups responded to these arrangements in different ways. For example, Sciencenter visitors often ran straight ahead to the first activity they saw in the space: 6 of 10 visitors coming from the first floor first stopped at Spectral Tubes while 2 of 4 entering from the stairs first stopped at Rover and the other two stopped at Build an Alien (See Images 3 and 4 for the entrance view at Sciencenter). With the arrangement at spectrUM, visitors were often first attracted to Rover (13 out of 30 stopped there first) or the Ocean Vents (13 out of 30 stopped there first) (See Images 5 and 6 for the entrance view at spectrUM).

Image 3: Main Entrance to Life on the Edge at Sciencenter



Spectral Tubes

Image 4: Stair Entrance to Life on the Edge at Sciencenter



Rover

Build an Alien

Image 5: spectrUM Entrance to Life on the Edge



Rover

Image 6: spectrUM Entrance to Life on the Edge



Rover

Ocean Vents

Visitors engaged with all aspects of the exhibition.

In addition to observing how visitors moved through the space, noting where they stopped for extended periods, the observation sought to capture what people did and said as they viewed or used *Life on the Edge* components. Table 2 depicts how many groups at each site had discussions or asked each other questions at various exhibits.

Table 2: Visitor Interactions at Exhibits

	Sciencenter	spectrUM
Rover	9 of 14	6 of 18
Ocean Vents	3 of 5	9 of 18
Track scope	3 of 4	3 of 8
Spectral Tubes	3 of 8	3 of 9
Build an Alien	2 of 9	2 of 13
Sample Microscopes	2 of 3	1 of 8
Orrery	2 of 5	1 of 11
Winogradsky Columns	0 of 2	2 of 6
Rover Models	1 of 2	0
Europa	0 of 1	0

The Rover, Ocean Vents, Track scope, Spectral Tubes, and Build an Alien generated the most interpersonal interactions observed during the evaluation. Interactions spanned from a child asking a parent for help or wondering what was on display to parents prompting children to try things out or explaining what they were noticing. The following are sample interactions and discussions observed at these exhibits.

Rover

- Father and older child look at rover.
 - Father and older direct the rover to the center.
 - Dad "So you got to look here (pointing to screen). You're telling it to go forward. To turn it around..." trails off as he moves blocks. Daughter watches.
 - Dad "So now you want to go forward, forward, turn right, then search." Daughter



Image 7: Rover exhibit

- tries moving blocks. They hit the button and watch.
 - Dad "Aah. So, function, it has you do everything down in this lower row." Dad sets it all up. "Try that and see what happens." Daughter presses button and they watch.
 - Dad "You found bacteria! So this is like computer programming. You tell it what to do in each step."
- Child instantly drawn to rover exhibit and went to control it as soon as it was unoccupied. Child asked if he could go inside the rover enclosure. Child spent a significant amount of time programming the rover.
- Child touched the blocks, hit the green button and watched it move. Picked up and put down a block, hit the button and watched the rover move. Ran out of the exhibit.
 - Parent did not say anything. Squatted at table and stood behind child at rover, possibly reading the panel text.

Ocean Vents

- Girl "What is this?"
 - Mom "This is supposed to be a giant tube worm."
 - Girl "Why is this coming out?"
 - Mom "There are worms in there. It is showing you how they move. It is a model to show you what's down there.
 - "These are tiny crabs!" boy
- 2 girls were first drawn to the moving tube worms ("Woah, look at that!"). They were excited, jumping up and down and bending to get a better look.



Image 8: Ocean vents exhibit

Track scope

- 4yo runs to track scope. Mom "Hold on, hold on. Figure out what you are doing first."
- Mom gives child directions for using track scope.
- Older boy runs to creature blocks and then returns to track scope: "There's living stuff in here!"
- Woman: This is what it looks like in the water."

Spectral Tubes

- Start at light wall, talking about colors and shadows. Then, child moved to spectral tubes. "That's neon. Mom, that's krypton." Mom and child do not pick up the diffraction wands.
 - Son: "Can we press all of the buttons?... That's awesome."
 - Mom: "Which one is your favorite?.. That's regular air?"
 - "Look how bright neon is," says boy with face against plexiglass.
 - Mom reads panel while son continues pressing buttons. "What are the kinds of invisible light? Light that we cannot see? Look at the first paragraph." "Infrared." "Infrared, good. What else?" "Ultraviolet." "Good!" mom say as son runs away.
- Adult and child explore spectral lines. Woman: "You can see more colors with the different gases."

Build an Alien

- Child walks to aliens and asks what to do. "I think it is just to read, want me to read it?" "Sure." Child is looking at tables as dad read post information out loud. Dad comes over to table. "Oh, I think you're supposed to make an animal." "Want to do it with me?" child asks. "No, you can." Child builds while dad pulls out phone.
 - Child creates an animal and places it on a shelf. "Dad. Dad!" Dad looks up from phone. "It's up!"
- Mom and girl move to aliens. Girl grabs a chair and sits down at the table.
 - Dad and son move to aliens. Parents watch as kids build.
 - Dad builds and helps daughter.
 - Mom to son "That looks kind of like a bear now." "I want it to live in the mountains." Boy places it in display.
 - Girl selects where to place her alien "Mommy can you put it up in those mountains up top? Daddy come look."
- Girl: "It's a giraffe! No, it's a dinosaur. Actually, it's a giraffe again. That's a daddy one. Where is a leg? That's a flamingo!" Girl laughed when mom showed her a creature made by another child.

VISITOR LEARNING AND EXHIBIT TAKEAWAYS

Life on the Edge is focused on connecting and educating visitors with the following big idea and focused exhibit goals.

Big Idea

Our exploration of extreme environments expands our understanding of life on Earth and the possibilities for life in our solar system and beyond.

Exhibit Goals

- Visitors will learn that life is all around us, hidden in plain sight.
- Visitors will understand the goals of NASA's missions to Mars.
- Visitors will use physical blocks to code a Mars rover and learn how biosignatures can be just as valuable in our search for life as life itself.
- Visitors will learn that using spectroscopy, scientists could reveal habitable planets beyond our solar system.
- Visitors will see models of extreme environments here on Earth, which will encourage visitors to imagine life forms that may exist in extreme environments on other planets.

Visitors connect with numerous aspects of the exhibition.

As they were leaving the gallery, visitors were interviewed to understand what they were taking from their time in the exhibition. Visitors were first asked what they thought the exhibition was about. The variety of topic areas and activities presented through *Life on the Edge* arose in respondents' answers. In particular, the Rover, building or creating animals (Build an Alien), the sample microscopes, and the ocean vents were named as being the topic of the exhibition. However, most respondents did not name a specific

topic as they described the exhibition, instead focusing on the variety and interactive nature of the exhibit components. As some interviewees shared, they had not “paid attention to the signs” as their children moved through the space, leaving the adults unsure of the content of the exhibition. Though many visitors may not have connected with specific exhibition content, they did connect with and appreciate other attributes of *Life on the Edge* as a space for exploration and imagination for their children. Below are sample quotes of what visitor shared.

What would you say this exhibition is about?

- **Life and wildlife (12)**
 - Different Life forms.
 - Life
 - All sorts of nature.
 - Light and making and finding animals.
 - Adult: Space and Earth exploration.
- **STEM Education (10)**
 - Hands-on participation and exploration about science for children.
 - Science concepts generally, ecosystems, coding. I’m not terribly sure.
 - Make children aware of science and be exposed to hands-on science activities they don't always get in school.
 - Learning for the young ones. Science, biology, robotics.
 - Science.
 - Getting children to become interested in science... Making it fun.
- **Mars or space (6)**
 - Exploration, understanding space and it's elements
 - Other worlds.
 - Child: It's about space!
- **Locations and geography (3)**
 - Science concepts generally, ecosystems, coding. I’m not terribly sure.
 - Different habitats.
- **Signs of life on other planets (3)**
 - I programmed the rover, which seemed to be on Mars... is the subject signs of life on other planets?
 - Exploring space and directing technology to study other planets.
- **Light (3)**
 - Light, spectrums, visiting areas that aren't visible to the naked eye.

- **Discoveries and scientists (2)**
 - Discoveries and people who made them.
- **Not sure / I did not pay attention (4)**
 - Not sure if there is a universal subject.
 - I haven't really take a close look.

Visitors most enjoy the Rover, Build an Alien, and the exhibition's interactivity.

Visitors were asked what they liked most about the exhibition. A third specifically named the rover while a fifth named the Build an Alien activity. Over two fifths of respondents spoke more generally about the interactive and engaging nature of *Life on the Edge*, appreciating the variety of ways that children and adults of all ages can engage with the activities and content. Below are some sample quotes.

What did you like most?

- **Informative and Engaging activities (13)**
 - Informative, engaging or all ages. I visit with children aged from 5 to 11 and they are very interested in the exhibits, despite the big age range.
 - Variety of things offered across the different exhibits is what I like most.
 - I like that it is interactive, and that it has different access levels for kids.
 - I like the hands-on activities, microscopes, and Mars rover the most.
 - There are lots of different science activities that are hands-on.
 - A good mix of levels of involvement. Both children of different ages and the adults are engaged by the exhibits. Younger kids can push buttons and build things, while older kids can read the signs and program the rover.
- **Rover (10)**
 - The Mars rover is my favorite part.
 - Figuring out the rover was good for me and my boys.
 - I enjoy watching the curiosity of my grandchildren as they figure things out at the various exhibits, especially the Mars rover exhibit.
 - I like the Mars rover. This is good problem solving for kids, even though it can be confusing. I worked with my son to figure out how much he should turn the rover.

- **Animals (7)**
 - My child liked the crab in ocean vents.
 - I like the Animal blocks and the tower where you display them.
 - Create a creature blocks, and the wall where they can display their creations are their favorite things.
- **Microscopes (2)**
 - Magnets are pretty fun. Microbial things in the dirt.
- **Other (6)**
 - It lets children use their brains and learn about science.
 - Very relaxed; children learn without pressure here.



Image 9: Build an Animal display tower

Visitors were also asked what they did not like or were confused by. Visitors had nothing negative to say. The few people who offered feedback generally requested for the Rover to be easier or more straightforward for their children to understand or for the sample microscopes and track scope to be easier to control. Here is the feedback:

- Kids can be confused by the dual microscopes. Where to look? The spinning samples look like a turn table.
- Movable microscope at the microbe colony can move too fast and it can be hard to focus.
 - I wish the instructions on the rover were clearer. Mars rover directions are confusing for younger ages.
- Some exhibits are NOT as interactive for younger children. [She feels some exhibits are too technical for her younger son.]
- I don't know how to explain some exhibits to my children.
- I couldn't get the microscope to focus real good.
- Learning how to program the rover is the most challenging thing. It can be tricky to rotate the rover the correct amount.
- Rover programming is hard - I am not to techie. The turning is difficult to understand.

Few visitors are thinking more about the content as they leave the exhibit.

Visitors were asked what questions they have or what they were wondering about as they left the exhibit. Most reported not having any questions as they were leaving *Life on the Edge*. Those who did have questions had very specific as well as general questions that they were considering. Two groups wondered “How long does it take for scientists to send a message from Earth to the rover on Mars?” and two others were thinking “about the possibility of life on other planets.”

- **Space travel and communication (2)**
 - How long does it take for scientists to send a message/commands from Earth to the rover on Mars?
 - Boy: “What to build. I made 3 animals.” Mom: “How long it takes to send and receive signals from Mars?”
- **Life on other planets (2)**
 - This exhibit makes me think about the possibility of life on other planets.
 - I’m thinking about the possibility of life on other planets, and our impact on local wildlife through the gold eagles exhibit.
- **Exhibit creation (2)**
 - I have so many questions about science, computers and how they are able to show the various exhibits.
- **Confusion based on not reading signs (2)**
 - I was confused about why whale fossil would be on Mars, but I did not read signage.
 - Better instructions on how to explain to younger children would be helpful for adults. I didn’t really read the current directions very closely, but as an example, I didn’t know how to explain the orrery beyond spinning the wheel.
- **Nothing (16)**
 - No lingering questions. Admittedly, I pay little attention to what the exhibits are actually about.
 - I haven’t read enough to formulate questions

Visitors believe the big idea is well conveyed through the exhibit.

Visitors were specifically asked about how well the exhibition conveyed the big idea. Even those visitors who reported not reading the exhibit content deeply felt that they recognized the big idea in their children's activities and through the different topics and hands-on activities they saw throughout the gallery. A third of respondents spoke to specific aspects of the exhibition that brought the big idea forward. In particular, the juxtaposition of ocean vents and space exploration helped them see how *Life on the Edge* was using exploration on Earth to understand how to explore other planets. Here are example quotes of how the big idea was being understood within *Life on the Edge*:

- **General praise (22)**
- **Specific praise (11)**
 - Portrays goal well; exhibits are looking at oceans, other worlds, and light refracting.
 - Pretty good job. I liked the exhibits about the Rover, water, and microfossils, in particular.
 - appreciated the Spanish translations that are available at every exhibit.
 - Pretty good, the ocean vents are a good example of how this goal is explored in a creative way.
 - Doing a good job. The Aquatic life and space exhibits are interesting ways to explore this goal.
 - Well; designing the animals for different environments is great for encouraging innovation.
 - Underwater is something I wouldn't have thought of. The oceans are the great unknown -- we even know more about space!

SCIENCENTER TEAM CHANGED THEIR DESIGN PROCESS

One of the broader goals of this project was to expand and deepen the skills of the Sciencenter exhibits team to design and build traveling exhibits. Between the fall of 2016 and summer 2022, the team experienced significant changes that may have influenced their development processes. During this period of time, significant political, social, and global shifts impacted how museums worked to support their communities. In particular, the COVID-19 pandemic upended all social, economic, and personal patterns, causing museums to close and staff to change work and personal practices. All of these individual and global shifts may have had an influence on the approach and development of the team designing *Life on the Edge*.

While external changes impacted the *Life on the Edge* exhibits team over time, team members focused on how they could learn, develop, and transform their design process throughout this project. Initially, the team focused on identifying and beginning to outline multiple components that might be a part of the final exhibition. This effort included diving deeply into researching and understanding the context and current science behind exoplanets and extreme environments and developing ideas for possible exhibits. Working in collaboration with Cornell researchers at the Spacecraft Planetary Imaging Facility (SPIF), the team explored how to highlight the cutting-edge research occurring within NASA and space exploration.

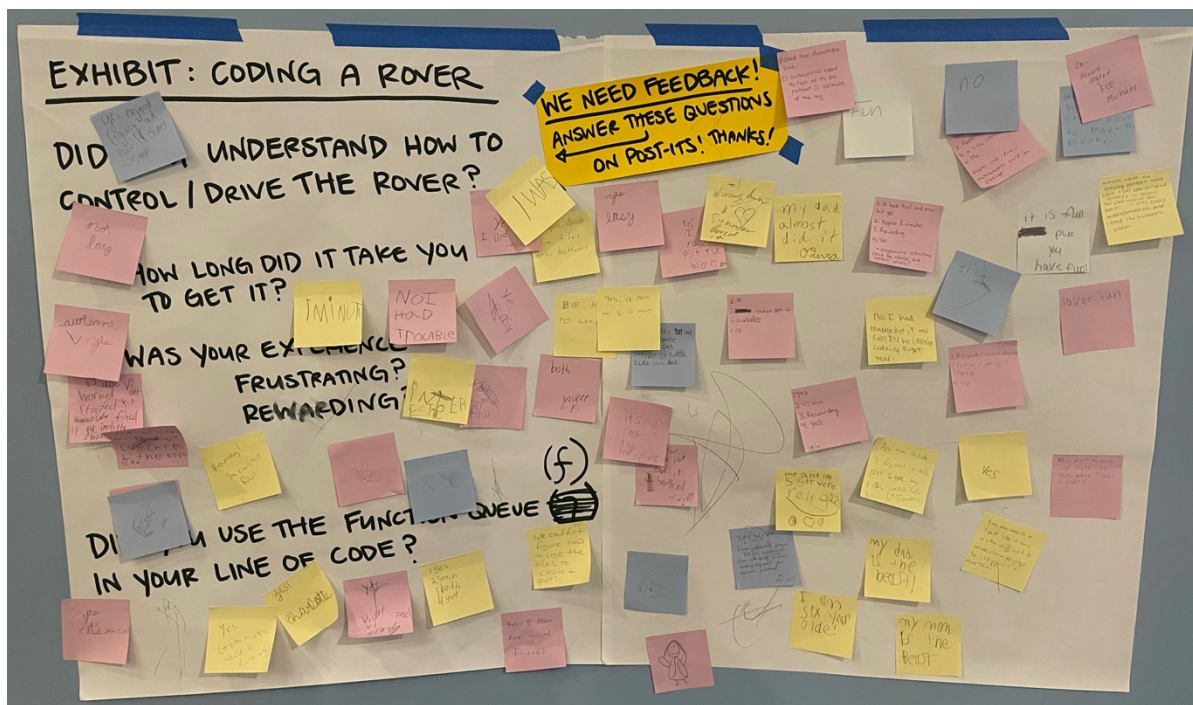
In October 2019, the Sciencenter team shifted their efforts from front end evaluation and research to finalizing the exhibition's big idea and visitor objectives. The team began identifying the most relevant content to begin prototyping. Using an intentional design process, the team conducted exhibit prototyping to check their ideas with museum visitors before fully building each exhibit component.

Prior to COVID-19 shutting down all exhibition development processes, the team was "cruising on getting prototypes out onto the floor," as the Exhibits Director shared on 2/27/2020:

In prototyping in the past few weeks, we were really focusing on: (1) thinking about if learning goals are being met and the indicators for how we know that, (2) the usability of the activities, and (3) we are testing our building methods with each one because we are not sure how we want to build it.

Integrating intentional prototyping into the design process was a new step for the Sciencenter team. By creating partially completed versions to present to museum visitors and allowing multiple exhibits to stand up together in the same space, the team was able to think holistically and critically together about the visitor experience. In late 2020 and 2021, the team developed and rolled out rough exhibit components for visitors. They included key questions on flip chart paper next to each component for visitors to respond to.

Image 10: Post-It feedback from visitors on prototype exhibits



The ongoing visitor feedback and ability to observe visitors using exhibits at different points in the development process helped the team improve and feel confident about each piece of the exhibition.

It worked really well, to have them in the space and getting post-its up there. All of us were in there with guests in ways that we wouldn't have done otherwise. We want to continue that and put more time and resources to that going forward. The rover especially benefited from it. We could see the development of it over time - evolving the experience, the directions, what are the problems that come up when it is used constantly. That all evolved into something that is really good. Now that we are building stuff for the final exhibition, we feel more confident because it was out on the floor for 3 months. (8/20/2021)

As the team embarks on the design process for a new exhibit, they are applying the design and prototype process they developed through *Life on the Edge*. During the COVID-19 pandemic, the team used flipcharts as a way to gather feedback from as many visitors as possible. “During Covid the visitors just trickled in, so we couldn’t really stand around observing them. We also did trainings with our education team and guest relations team so they knew what kinds of questions and challenges had so they could report back to us about things they noticed.” As visitation patterns return to pre-pandemic levels throughout 2022, exhibits staff are directly observing visitors using prototype exhibits and asking them questions about their experience.

In addition to continuing to prototype exhibits with visitors, the Sciencenter team continues to further integrate partnerships with scientists. Partners play multiple roles in projects, most importantly to assess the accuracy of the science content museum staff draft. Partners are invited into the ideation phase of the project, identifying potential ideas for exhibit content. As components are developed by Sciencenter staff, partners are invited back to review and discuss the content, activities, and offer their insights to support the project’s refinement.

CONCLUSIONS

The *Life on the Edge* exhibit successfully conveyed its big idea to visitor groups. Every area of the exhibition attracted and engaged visitors, with the interactive components holding children's attention for an extended period of time. As further evaluations are conducted on Life on the Edge, greater understanding of the unique impact upon 8- to 14-year-old children will be captured.

Of particular interest were the Rover and Build an Alien exhibits, which held children and adults' attention for extended periods. These were some of the exhibits that also generated the most conversation among members of a visiting group, along with Ocean Vents and the Track scope.

Exploring how to present the current science around exoplanets, extremophiles, and extreme environments offered the Sciencenter team an abundance of ideas, possibilities, and interesting problems to navigate. Through the process of brainstorming, researching, narrowing, and finalizing the exhibits focus, the Sciencenter design team developed new practices that they are carrying into future exhibit projects. Through conference presentations and webinars, the team is also hoping to share their practices with other museum professionals, improving the development process across the sector.

APPENDIX

Observation

Visitors at each museum were observed as they moved through *Life on the Edge*. Observers noted where visitors paused to read or look at exhibit components, how they engaged with the different activities, and what they discussed together. Observers used an open observation process, tracking how visitors move through the space on a layout map and writing what they see and hear visitors do or say.

Interview Responses

What would you say this exhibit area is about? (n=34)

- **Locations and geography (3)**
 - Some geography.
 - Science concepts generally, ecosystems, coding. I'm not terribly sure.
 - Different habitats.
- **Life and wildlife (12)**
 - wildlife topics are covered.
 - Different Life forms.
 - Life
 - Science, exploring the natural world, physical science.
 - Science and the natural world.
 - Wildlife, outdoors, exploring
 - Exploring and hands-on
 - Life, how life works.
 - All sorts of nature.
 - Girl: It's about space and making animals.
 - Boy: Light and making and finding animals.
 - Adult: Space and Earth exploration.
- **Signs of life on other planets (3)**
 - I programmed the rover, which seemed to be on Mars... subject is signs of life on other planets?
 - Mom: Exploring space and directing technology to study other planets.

- Adult: Space and Earth exploration.
- **Mars or space (6)**
 - Migrating birds [Golden Eagles] and Mars? Not sure if there is a universal theme. [spectrUM has exhibits covering other topics in the same gallery]
 - Exploration, understanding space and it's elements
 - Other worlds. Science [contributed her daughter.]
 - Boy: It's about space!
 - Girl: It's about space and making animals.
 - Mom: Exploring space and directing technology to study other planets.
- **Discoveries and scientists (2)**
 - Discoveries and people who made them.
 - Building and putting things together [is the goal for specifically the create a creature blocks.]
- **Light (3)**
 - "Light, spectrums, visiting areas that aren't visible to the naked eye" or are usually accessible.
 - Mom: Remember how we were talking about space on the way here and then we learned about light?
 - Boy: Light and making and finding animals.
- **Not sure / I did not pay attention (4)**
 - Not sure if there is a universal subject.
 - Kids love it! I don't know exactly the purpose of the exhibit. I didn't pay a lot of attention to what the signs say. [She keeps coming back because her children love it so much.]
 - I haven't really take a close look. [He was reading a book at the COVID bench when I approached.]
 - I haven't had a chance to explore the exhibits in detail. [She was sitting on the rover bench as MC and MA programmed the rover.]
- **STEM Education (10)**
 - In general, spectrUM promotes STEM education and creativity in children. [Didn't comment on specific subject of the exhibits.]
 - SpectrUM is for teaching and satisfying kids' curiosity for science.
 - Hands-on participation and exploration about science for children.
 - Science concepts generally, ecosystems, coding. I'm not terribly sure.
 - Make children aware of science and be exposed to hands-on science activities they don't always get in school.

- Learning for the young ones. Science, biology, robotics.
- Science [her granddaughter enjoys exploring the exhibits.]
- Science.
- Getting children to become interested in science... Making it fun.
- You learn stuff that you normally wouldn't at home. Kids can learn through play without realizing it. [As an adult, she is also interested in the exhibits.]

What did you like about this exhibit? (n=34)

- **Animals (7)**

- Activity wildlife, because my children love wildlife.
- Child liked crab in ocean vents.
- Mars rover, and create a creature blocks are the most popular with my family.
- I like the Animal blocks and the tower where you display them.
- Create a creature blocks, and the wall where they can display their creations are their favorite things.
- Building and testing things.
- Building the animals. And the lights (spectral tubes).

- **Rover (10)**

- The Mars rover is my favorite part.
- The Mars rover is "loved" by her daughter. "Programming and seeing the results right away is great for her." Creature blocks-building specific animal models with provided instructions would be cool.
- Figuring out the rover was good for me and my boys.
- Mars rover programming is fun, in particular.
- Mars rover, and create a creature blocks are the most popular with my family.
- I enjoy watching the curiosity of my grandchildren as they figure things out at the various exhibits, especially the Mars rover exhibit.
- The Mars rover is really cool and fun to program. My daughter enjoys doing that.
- I like the hands-on activities, microscopes, and Mars rover the most.
- I like the Mars rover. This is good problem solving for kids, even though it can be confusing. I worked with my son to figure out how much he should turn the rover.
- My kids like the rover quite a bit.

- **Informative and Engaging activities (13)**

- Informative, engaging or all ages. I visit with children aged from 5 to 11 and they are very interested in the exhibits, despite the big age range.

- I like how the exhibits are located in the space and the fact that they are spaced out. I like the display and arrangements of the exhibits in the space.
- Being able to spend time in a space with hands-on activities and exhibits is a great resource for the Missoula community.
- Variety of things offered across the different exhibits is what I like most.
- I like that it is interactive, and that it has different access levels for kids.
- I like the hands-on activities, microscopes, and Mars rover the most.
- There are lots of different science activities that are hands-on.
- I like the Interactive elements of the exhibits.
- The hands-on for the kids.
- A good mix of levels of involvement. Both children of different ages and the adults are engaged by the exhibits. Younger kids can push buttons and build things, while older kids can read the signs and program the rover.
- I like that kids of every age range are interested in the exhibits. There is something for all ages.
- All the colors in the exhibits draw my kids in.
- The variety.
- **Microscopes (2)**
 - I like the hands-on activities, microscopes, and Mars rover the most.
 - Magnets are pretty fun. Microbial things in the dirt.
- **Other (6)**
 - The videos [not Life on the Edge related].
 - It lets children use their brains and learn about science.
 - Something new every week.
 - That it is kid-friendly and gives them exposure to topics in science.
 - Some things that are always here and others, like the earthquake simulator from last week, are only here temporarily. We never know what we will find here.
 - Very relaxed; children learn without pressure here.

What did you not like about it? (n=34)

- Nothing. (27)
- Kids can be confused by the dual microscopes. Where to look? The spinning samples look like a turn table.
- None, I love this.

- Movable microscope at the microbe colony can move too fast and it can be hard to focus. I wish the instructions on the rover were clearer. Mars rover directions are confusing for younger ages.
- Dislikes is that some exhibits are NOT as interactive for younger children. [She feels some exhibits are too technical for her younger son.]
- I don't know how to explain some exhibits to children.
- I couldn't get the microscope to focus real good.

What did the exhibit make you think or wonder about? Do you have any questions about anything as you are leaving this area? (n=28)

- **Nothing (15)**
 - [Enjoying the exploration of his grandchildren as they check out the exhibits. No lingering questions.]
 - No lingering questions. Admittedly, I pay little attention to what the exhibits are actually about.
 - No lingering questions. I don't really think about the deeper meaning of the exhibits.
 - Not really any questions about the area. I think about the various science activities.
 - Not really any questions about exhibits. I'm thinking about science at large.
 - The difference exhibits and topics covered. Signs are helpful for explaining to children, No lingering questions
 - No questions. The kids have so much fun everytime.
 - I haven't read enough to formulate questions.
 - Haven't put much thought into it. I like to allow my kid to be engaged with all the exhibits.
 - Not that I can think of.
 - I don't think so. (2)
 - No questions or thoughts to report.
 - It is cool to see what my daughter is interested in. No questions of my own.
 - I should have paid more attention in school! If science had been taught in an engaging way like this, I would have been more interested.
 - I was focused on my kids while in the space, so I don't really read the signs. It is great how accessible the space is. No lingering questions.
- **Confusion based on not reading signs (2)**
 - I was confused about why whale fossil would be on Mars, but I did not read signage.

- Better instructions on how to explain to younger children would be helpful for adults. I didn't really read the current directions very closely, but as an example, I didn't know how to explain the orrery beyond spinning the wheel.
- **Life on other planets (2)**
 - This exhibit makes me think about the possibility of life on other planets.
 - I'm thinking about the possibility of life on other planets, and our impact on local wildlife through the gold eagles exhibit.
- **Exhibit creation (2)**
 - No questions, and I'm interested in the wide range of exhibits on display.
 - I have so many questions about science, computers and how they are able to show the various exhibits.
- **Rover-related (2)**
 - Learning how to program the rover is the most challenging thing. It can be tricky to rotate the rover the correct amount.
 - Rover programming is hard - I am not to techie. The turning is difficult to understand
- **Space travel and communication (2)**
 - How long does it take for scientists to send a message/commands from Earth to the rover on Mars?
 - Boy: "What to build. I made 3 animals." Mom: "How long it takes to send and receive signals from Mars?"
- **spectrUM specific (6)**
 - [He is curious about the Discovery Bench activities, when they take place, and what they are.]
 - What is happening with the insectarium at the discovery Bench? It's spider day!
 - No, but her son always has many questions about the exhibits and Discovery Bench activities.
 - Suggestion: More resources with 3-4 library books that are related to the subject for the week. Then kids could easily find and check out relevant books.
 - I want a set of Cubelets! There is always something at the Discovery Bench that he is interested in and wants to do.
 - DNA climber: What is it? When will it be done?

ADULTS: The big idea or goal for this exhibition is “Our exploration of extreme environments expands our understanding of life on earth and the possibilities for life in our solar system and beyond.” How well do you think the exhibit portrays this goal in different ways? (n=33)

- **General praise (22)**

- Excellent job.
- Pretty good job, diverse topics and exhibits that convey the goal well. I appreciate the wide range of exhibits.
- This goal is conveyed well through the visuals and hands-on activities in particular.
- Great, I appreciate the diversity in the exhibits.
- The exhibits do a fine job of exposing you to science topics. The country has a long way to go in regard to scientific literacy.
- Outstanding The different exhibits convey this goal well.
- Good, spectrUM creates an atmosphere that encourages kids to learn new things and know more about STEM subjects. It creates an atmosphere of knowing and learning.
- 8 or 9/10. Quite well, and the range of exhibits is great.
- Portrays this well. Different examples and ways to view things is enlightening for adults as well.
- Really well. The kids are drawn in to everything and ask questions about the science concepts and explored in the exhibits.
- A wonderful job.
- Pretty well
- Great
- This goal seems to be portrayed well, but we didn't read any of the signs in detail.
- Really well.
- 8/10
- Well
- A lot of different levels of involvement to convey this goal well through the various exhibits that engage all ages.
- Does it well
- Nailed it
- Very good.
- Yes, I think so, but I didn't really look at a lot of it.

- **Specific praise (11)**

- Portrays goal well; exhibits are looking at oceans, other worlds, and light refracting.
- Pretty good job. I liked the exhibits about the Rover, water, and microfossils, in particular.
- The exhibit does a good job conveying this goal through its little station" that explore various topics.
- The exhibit is better than average at portraying this goal. I also appreciated the Spanish translations that are available at every exhibit.
- Pretty good, the ocean vents are a good example of how this goal is explored in a creative way.
- Doing a good job. The Aquatic life and space exhibits are interesting ways to explore this goal.
- Well; designing the animals for different environments is great for encouraging innovation.
- Medium maybe. Ocean vents isn't very interactive... I don't get the sense that we are learning about extreme environments. I see an ocean exhibit and a space exhibit but I didn't make the connection about extreme environments.
- Underwater is something I wouldn't have thought of. The oceans are the great unknown -- we even know more about space!
- I think well. I like that there is a wide variety -- Oceans, Mars, Lights [spectral lines].
- Good. The animals and the tube worm display.

Interviewee Demographics

Gender of Interviewed Adult

	Count
Man	5
Woman	29

Race of Interviewed Adult

	Count
White	2
Black or African American	1
Asian	1

Age of Child(ren) in Group

	Count
2-4	11
5-7	32
8-12	12
13+	1