

From Takeoff to Landing: Looking at the Design Process for the Development of *NASA Blast* at Thanksgiving Point

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In this article we discuss the process of design used to develop and design the *NASA Blast* exhibition at Thanksgiving Point, a museum complex in Lehi, Utah. This was a class project for the Advanced Instructional Design Class at Brigham Young University. In an attempt to create a new *discourse* (Krippendorff, 2006) for Thanksgiving Point visitors and staff members, the design class used a very fluid design approach by utilizing brainstorming, researching, class member roles, and prototyping to create ideas for the new exhibition. Because of the nature of the experience, the design class developed their own techniques to enhance the process of their design. The result of the design was a compelling narrative that brought all the elements of the exhibition together in a cohesive piece.

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Introduction

What do you do when you are given the assignment to fill a large, 3,200 square foot room and turn it into a learning place where children and parents can learn about science together? Such was the challenge given to the Advanced Instructional Design Class, a part of the Instructional Psychology and Technology Department at Brigham Young University (BYU).

The class took the assignment from Thanksgiving Point, a nonprofit museum complex in Lehi, Utah (www.thanksgivingpoint.org). Thanksgiving Point is known for its Museum of Ancient Life, one of the world's largest dinosaur museums; its Farm Country, a hands-on live animal park and working farm; and its 55-acre estate Gardens and Children's Discovery Gardens. Thanksgiving Point is a major center promoting educational experiences for families.

During the course of a semester from January 2010 to mid-April 2010 the design class encountered and solved many design challenges. These included defining the design problem in context of the complicated subject matter; dealing with the constraints of budget, space, and time; designing for exhibits that were unknown to the design class members; helping foster parent-child experiences with each exhibit that would fit into a narrative for the entire exhibition. In order to provide a richer description of the design process, comments from the designers are included in comment boxes throughout the document.

Choosing the Project

In early January 2010 the design class took a fieldtrip to Thanksgiving Point, about 21 miles north of BYU, to see which projects were available for selection. There were two main contenders (see [Comment 1](#)). The class could develop a number of interactive exhibits for a new museum called the Museum of Natural Curiosity, a hands-on children's museum; or they could create a plan for housing a set of traveling exhibits from the Exploratorium, a hands-on science center in San Francisco (www.exploratorium.edu).

Comment 1

“Being able to select our project provided an opportunity for our newly formed design group to evaluate the background, knowledge, experience and skills of the group as a whole. This was a valuable experience in assessing the possible strengths and weaknesses of our group given the selection of different projects.”

-Anne

Comment 2

“I was worried that if we chose this project that the plans we created would somehow become obsolete between now and the time the museum was built. Or they would change so much they would be unrecognizable. I wanted our class to have more control.”

–Stephen

Comment 3

“I also was afraid that having to wait two years to see the results of our efforts would prevent us from having an experience that would reinforce what we had learned in class.”

–Dan

Comment 6

“As a grant professional, this opportunity was appealing but troublesome also. I understood the requirements of a grant and the potential limits this could take. As we worked throughout the semester I kept reminding the class that designing to the grant was a poor idea. We needed to design to the client and our ideas and deal with the grant when and if it was funded.”

–Aaron

Designing exhibits for the Museum of Natural Curiosity seemed very compelling, because the class would have a hand in designing a prototype for a brand new museum. However, the new museum had not been built yet and was not scheduled to be completed for a couple of years. The students would likely not be able to see the fruits of their design labor (see [Comment 2](#), [Comment 3](#), and [Comment 4](#)).

Thanksgiving Point was scheduled to receive a traveling exhibition about light from the Exploratorium from June 2010 to June 2011. Creating a narrative that tied all the exhibits together was much more visible and immediate. This project required the redesign of the large, open, 3,200 square foot traveling exhibitions room called the Discovery Room. However, because the traveling exhibits had already been selected, this project seemed at first not to lend itself to creative ideas. As will become apparent, this impression turned out to be wrong.

As the class considered these options, a new development occurred. The class was notified that Thanksgiving Point was resubmitting a grant proposal to the National Aeronautics and Space Administration (NASA) to invite them to fund the costs of the traveling exhibits from the Exploratorium with a grant amounting to about \$180,000¹ (see [Comment 5](#)). Thanksgiving Point had a strong case for the grant but needed to make stronger connections between light and space exploration, and they needed to submit a detailed evaluation plan.

The possibility that NASA might fund the light exhibits acted as the final sweetener for the decision. The members of the design class enthusiastically agreed to undertake the NASA related project, knowing they would also get to participate in the submission of a major grant proposal (see [Comment 6](#), [Comment 7](#), and [Comment 8](#)). This grant helped determine the direc-

Comment 4

“During our field trip to Thanksgiving Point I became a little concerned about the groups overwhelming excitement about designing an exhibit for the museum of Natural Curiosity. I was afraid that the project was too big and could easily overwhelm us with our resources and time constraints. I was grateful that the class decided to choose something smaller that we could do well.”

–Carrie

Comment 5

“I was really excited about this grant proposal. Never before had Thanksgiving Point received such a high-profile grant. If they could secure this grant it would lead them to gain other large grants in the future. This would set a precedence for them.”

–Stephen

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Comment 7

“Honestly, I remember my heart conflicted at this point! A further constraint was applied to our design project. We now had to clearly identify the connections between NASA curriculum and the pre-selected light exhibits. Having a background in education, I was concerned when my idea box was empty during a lot of our initial discussions.”

-Anne

tion for the class as they developed the exhibit theming.

The remainder of this article describes the design that emerged, the problem solving process of the design team, and an assessment of the successes and lessons learned during the project. The design class knew Thanksgiving Point was going to receive twelve exhibits about light from the Exploratorium. These exhibits would be hands-on and would showcase different principles of light, including reflection, refraction, diffraction, absorption, and color creation. (Because of the nature and restraints of this article, no further descriptions

will be given about the individual exhibits from the Exploratorium.) The class needed to make connections between light and space exploration, help create a detailed evaluation plan, tell a compelling narrative that tied all the exhibits together, and then fill the Discovery Room with the Exploratorium exhibits. The Discovery Room is housed in a world-class museum complex with an international reputation. The quality stakes were high.

Creating an Evaluation Plan

Two problems were presented to the class when they accepted the assignment to help with the NASA related project. First, the class agreed to write a detailed evaluation plan that would become a part of the grant. Second, because of the requirements of the grant, the class needed to make connections between space exploration and light, which was the theme of the traveling exhibits.

To accomplish the first challenge the design class enlisted the help of one of the professors in the Instructional Psychology and Technology Department who was an expert evaluator. With his help the class created both a formative and summative evaluation plan (see [Comment 9](#)). The NASA grant request for proposal also recommended using an evaluation plan similar to one outlined in the “Framework for Evaluating Impacts of Informal Science Education Projects” report written by the National Science Foundation (Friedman, 2008). Because of that, and the recommendations of a National Science Foundation document, the class created an evaluation matrix that outlined the goals/objectives, evidences, data, instruments, and measurement procedures that would be used to evaluate the effectiveness of the NASA programming at Thanksgiving Point. The class had to decide what the primary evaluation objectives were before the design problems were clearly

defined (see [Comment 10](#)). The final evaluation plan was very thorough yet open-ended enough that the design class would have the flexibility to create a compelling environment and narrative for the traveling exhibits. The design class also learned that urgency was a motivating tool to come up with design solutions quickly (see [Comment 11](#)).

Comment 8

“While I was excited by the prospect of having NASA fund our exhibit I was also very intimidated by the idea of helping to put together a proposal for such an important donor. I had almost no grant writing experience at the time and had never taken part in a formal evaluation. But I was amazed at what we were able to do as a team to put this grant together.”

-Dan

Comment 9

“I was excited about creating an evaluation plan, because I knew our team had the expertise and resources to compose something great. Some of the staff members at Thanksgiving Point were elated when they saw how thorough our plan was.”

-Stephen

Comment 10

“I believe the grant gave a focus to the design development that we did not yet have.”

-Keith

Comment 11

“Throughout the stage of revising the grant, I learned the value of fully investing in situations of urgency. At first the added task was daunting and seemed to take us further away from our design process and product completion. Yet, it was appreciating and running with the circumstance of urgency that propelled our design into defining our problem, parameters, purpose, and direction.”

-Anne

The Brainstorm-Research Cycle

For the class, the first substantial stumbling block during design was encountered when trying to understand the subject matter. However, understanding the subject matter led to some of the most meaningful design features of the exhibition space. Before outlining *what* the design class discovered, it is important to understand *how* the design class made their discoveries using a unique design process.

Much of the design process that the class followed was influenced by applicable design literature, which will be discussed later in this section; some of the process was created out of necessity. For the first few weeks every class period was broken into two parts. The first part was a review of one of three design literature books as directed by the professor, *The Semantic Turn: A New Foundation for Design* by Klaus Krippendorff, and *The Art of Innovation* and *The Ten Faces of Innovation*, both by Tom Kelley. The second part of the class was focused on

the actual design assignment. During the literature review the class decided that what they hoped to create was a *discourse* as defined by Krippendorff (2006). Discourses “direct the attention of community members, organize their actions, and construct the worlds they see, speak of, or write about” (p. 11). When a designer creates a new understanding for a user, the user’s culture, or personal discourse, is changed. The goal of exhibition design was to affect the discourse of parents and children who experienced the exhibition, adding new terms to their family conversations. This meant changing the discourse of the Thanksgiving Point exhibition developers as well, helping them become even more visitor- and experience-oriented than they already were (see [Comment 12](#)). The class also wanted to do more than just create displays that explained the connections between light and space exploration. They felt empowered to not only impact visitor experiences, but to help visitors become more engaged with the people and world around them, both at the museum and at home.

The design class wanted to create a meaningful discourse but needed the right tools. Kelley’s *The Art of Innovation* (Kelley, 2001) encouraged the class to brainstorm early on in the process. The purpose of the brainstorming sessions was to come up with additional ideas to enhance

visitor experiences as they engaged with the exhibits. Kelley’s book prompted the class to encourage wild ideas, represent ideas graphically, and to go for quantity of ideas, all while withholding judgment (p. 57-58). At the early stages of the brainstorming the class members did their best to ignore the constraints of space and budget to generate a quantity of ideas (see [Comment 13](#), [Comment 14](#), and [Comment 15](#)).

Class members tailored the brainstorming to fit the personal research about light and space exploration they were already conducting (see

Comment 12

“Having worked as a school psychologist and an educator, I was particularly invested in this goal. I too often had seen a problem with individuals being able to effectively ask questions, gather information and make informed decisions. Our goal for our end product was for the exhibit activities to ignite the development of basic learning and problem solving skills. Our ultimate desire was for these skills to transfer use into other aspects of the individual patron’s life.”

-Anne

Comment 14

“Withholding judgment was critical to the flow of ideas. I’ve been in brainstorming sessions outside of this experience where some very innovative ideas were thrown out due to criticism early on. Putting everything on the table during these brainstorming sessions was one of the greatest sources of innovation.”

-Anne

Comment 13

“I think the emphasis on quantity and deferment of judgment really helped with our design process.”

-Isaku

Comment 15

"I really struggled at first with the brainstorming sessions. There were a few times that I felt the class was wasting time discussing ideas that I knew we would never be able accomplish. The group helped me see that good brainstorming was free of restrictions which produced some really good ideas that we were able to bring about."

-Carrie

Comment 16). Each class period, after a discussion on the design literature, the class members would present design ideas for the project, as well as what they had learned about light, during a brainstorming session. The design ideas brainstormed were tied together with the class's ever-growing understanding about light. After each brainstorming session, class members voted on the ideas they liked best. But these ideas were not complete; they required further investigation.

An example brainstorm would be as follows. In no particular order one of the students would stand up in the front of the classroom. He or she would then draw something on the whiteboard and write down key words or phrases to describe his or her idea. Sometimes the ideas would be purely theoretical to help all the class members understand the subject matter better. Other times the idea would be about a particular exhibit or about the entire exhibition's theming. The other class members would listen and ask questions to clarify the idea. No negative critiquing would take place at this time. After the student had presented his or her idea the other class members would have opportunities to build upon the idea, often by coming to the front and adding their own phrases and pictures to the current idea. It was not uncommon for the class to come up with more than 75 ideas in a 60-minute time period (see Figures 1 and 2).

Comment 16

"Dr. Gibbons made sure our class had a number of large whiteboards. These whiteboards allowed for quick representation of ideas throughout the brainstorming session. If someone had a new idea or wanted to add on to another, they would get up, take a whiteboard pen, explain it, and represent it on the board. Whiteboarding was a very effective design process that our group used on close to a daily basis."

-Anne

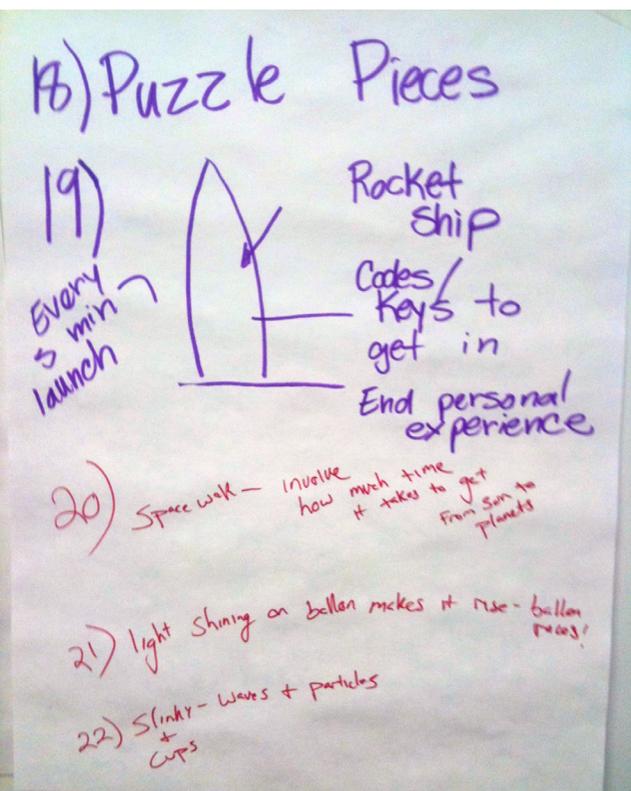


Figure 1 (left)

This is a picture from one of the first brainstorming sessions.

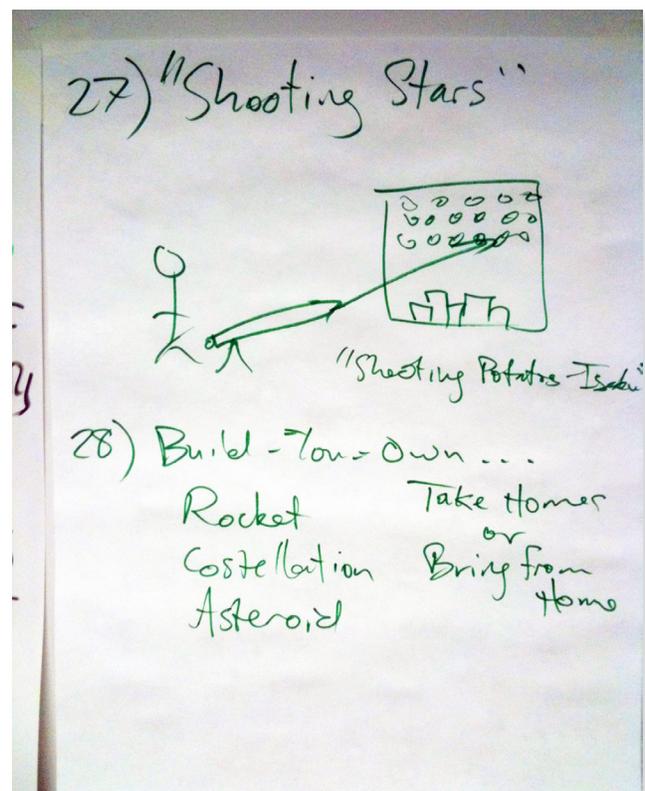


Figure 2 (right)

This is another picture from one of the first brainstorming sessions.

To determine which brainstormed ideas to pursue, class members relied upon innovative roles as prescribed by Kelley (2005) in *The Ten Faces of Innovation*. In his book Kelley identifies ten roles that design team members can adopt to promote creativity in their design. Near the beginning of the semester the class members assumed different roles based on their individual strengths and interests. All ten of Kelley's roles will not be discussed here; however,

Comment 18

"I didn't necessarily view myself as "an experimenter". Yet, after reading Kelly's description, I realized this was a role that I could fill in our group. I made several different visits to dollar stores throughout our project. It was fun to gather inexpensive items that promoted play and creativity. In the beginning I gathered different types of glasses, lenses, toy binoculars, small flashlights, prisms, etc. At our meetings, I usually had my plastic soapbox filled with items. It was good to have these resources on hand as we discussed principles of light and were able to actually experiment right then. Bringing various objects was a very useful design process that ignited our own creativity and innovation."

-Anne

some of the roles adopted by the class members included *Director*, who, because he was an employee of Thanksgiving Point, acted as a liaison with the class; *Set Designer*, who focused her efforts on creating a believable, life-like exhibit environment (see [Comment 17](#)); *Experimenter*, who always brought new objects for class members to tinker with and manipulate (see [Comment 18](#)); *Caregiver*, who always reminded us to empower all the disenfranchised museum visitors that would pace through the exhibition; and *Storyteller*, who literally drew the picture of what the experience would be for the visitors. Other class members embraced meaningful roles also. Each brainstormed idea fit one or more of the roles, thus allowing easy delegation of class assignments. For example, the Set Designer received assignments that dealt with the look and feel of the exhibition. If there was an idea that the class liked regarding the environment, she researched it further and returned to the next class, ready to share and brainstorm some of the ideas she had developed.

This became the *brainstorm-research cycle*, which repeated itself through the entire semester (see [Comment 19](#)). The class followed this pattern of brainstorming as a team, selecting favorite ideas, delegating assignments based on roles and abilities, individually researching the ideas, and returning to report on findings and receive feedback (see [Figure 3](#)). This cycle promoted both individuality and team unity (see [Comment 20](#)).

Over the semester the purpose of the brainstorming sessions gradually shifted. They became much more focused on single ideas. To focus on human-centered designs, some of the brainstorming sessions

Comment 17

"One of the things I enjoyed most about this project was discovering that I was a set designer. I really got excited about my role and I was absolutely thrilled to see my ideas realized."

-Carrie

Comment 19

"This had to be one of my favorite parts of the class. We came up with some really wild and fun ideas. Some of our ideas that never made it past the classroom were a tree house control room that allowed users to manipulate the rest of the exhibits in the room, having staff members dress up like astronauts, and turning half of the exhibition room into the International Space Station."

-Stephen

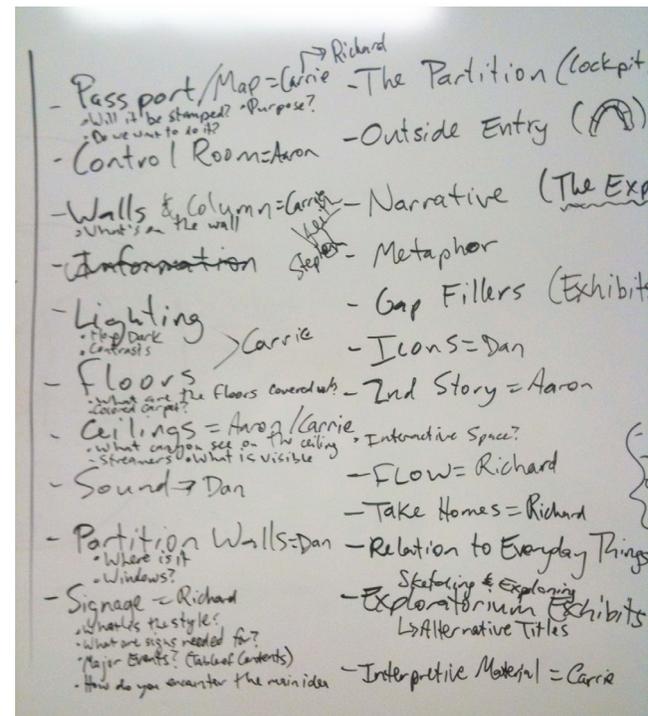


Figure 3

This picture of the white board illustrates how differing assignments were given to different class members based on their roles.

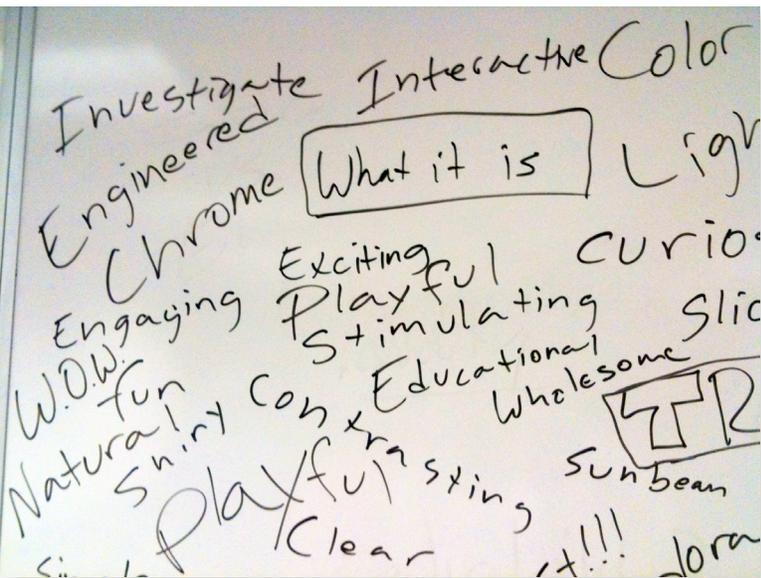


Figure 4

This whiteboard photograph portrays the adjectives used by the design class to describe what they hope the exhibition *will* be.

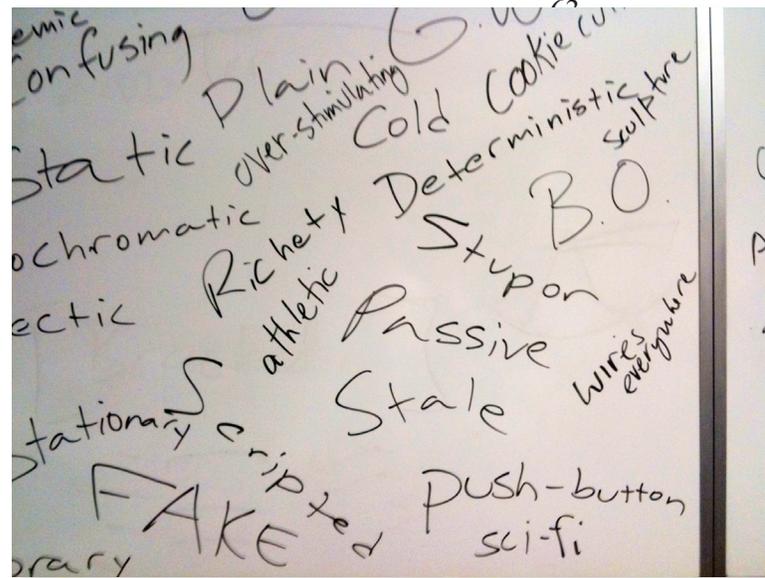


Figure 5

This whiteboard photograph portrays the adjectives used by the design class to describe what they hope the exhibition *will not* be.

Comment 20

“The opportunity to work in a team and truly collaborate after we had each done extensive research was very enriching. I feel the discussions we shared, coupled with brainstorming and working with the model, helped us become one as we progressed toward a finalized design.”

-Richard

were spent identifying what the exhibition space was and what it was not (see Figures 4 and 5; Krippendorff, 2006, p. 230-240). The class members hammered through ideas until they became of one mind. This was very challenging (see [Comment 21](#)). But the resulting ideas were sound and well grounded. They could not have been developed individually (see [Comment 22](#)).

Comment 21

“Becoming of one mind takes sacrifice. There were a number of times, I really didn’t know why we were going over a concept or idea again. Yet, it is through hearing each individual out, critically thinking of factors, and good questioning that we came to see the big picture together. It was at this point that communication and uniform design became a fluid process for our group.”

-Anne

Understanding the Subject Matter: The Gateway to the Solution

The class came to understand the subject matter through the use of the brainstorm-research cycle. This led to the discovery of the conceptual *epitome* of the subject matter (Reigeluth, 1999). The following paragraphs outline what the class discovered. It is important for the reader to understand the basics of the subject matter, because it will tie all the other design decisions together (see [Comment 23](#)).

Comment 23

“We all had different levels of experience and funds of knowledge regarding light and space. Coming to a clear, factual based understanding of the subject matter was an essential step in our design process. All of us in the group needed to have the basics of the subject matter in order to share the vision and communicate ideas clearly and effectively.”

-Anne

The class discovered that the light that we see with our eyes is called visible light. That visible light is actually a very small portion of a greater spectrum called the electromagnetic

radiation (EMR) spectrum. It is common for scientists to call this entire EMR spectrum the “light spectrum.” The EMR spectrum includes many different types of light waves, including radio waves, microwaves, infrared rays, visible light rays, ultraviolet rays, x-rays, and gamma rays. The visible light that we see is just an infinitesimally small amount of the full spectrum. Scientists use these various forms of light to study stars, planets, and outer space in general.

All types of light along the EMR spectrum share similar properties (see [Comment 24](#)). Each of them reflects, refracts, and absorbs. If we can understand how visible light works, then we can understand how the invisible light works as well. Then we can understand outer space much more fully, as the scientists are using their tools to explore it. For the class this was the crux of the matter; it was the connection between light and space exploration that NASA required in order to obtain their grant. Visible light was the gateway to understanding the other non-visible types of light; thus our understanding of outer space is expanded when we learn to “see” and interpret the other types of light.

This discovery did not come through happenstance. One of the class members was very knowledgeable about light and the EMR spectrum and had worked on another NASA related project before; however, the rest of the students needed to learn more. Most of the knowledge was obtained through performing Google searches, reading Wikipedia articles, and verifying the information found there against other credible, NASA related websites. As part of the brainstorm-research cycle, the students would then come to class to report on what they had learned, often teaching each other about scientific theories or drawing graphical representations to explain difficult concepts. The knowledgeable class member would clarify misunderstandings about light when they arose.

Comment 25

“Understanding the subject matter was no small task. The more I studied the more I realized how much I didn’t know. But, this task was crucial to being able to design a meaningful and exciting experience for others.”

-Carrie

It took the design class several weeks to solidify this new understanding about light. However, once it was understood, developing a narrative and theming to tie everything together became feasible (see [Comment 25](#)). The class could now design a layout, look, and overall environment of the exhibit, because they knew how the exhibits and space exploration could be connected (see [Comment 26](#)).

Comment 26

“There was a lot of satisfaction that came in arriving at this point in our design work. It was this climax that was a reward for the extra effort that this process had required.”

-Anne

Obtaining a Shared Vision

Once the class knew that visible light was the gateway to understanding other light waves, they worked to create a narrative and *design coherence* that would bring everything together (Brooks, 2010). It became apparent that the class needed a better understanding of the physical space they were developing. Kelley recommended the use of prototyping, so the class created a scale model prototype of the Discovery Room out of foam board (Kelley, 2001, p. 101-118). Scale models of people and exhibits were also created for the model (see Figure 6 and [Comment 27](#)). While this prototype was very helpful and helped facilitate more ideas, it was not enough. The class developed many ideas for a narra-

Comment 27

“I have to admit that I was skeptical of this assignment at first. I believed having a 3-D model would not make it any easier to create the design than using a traditional blueprint. However it helped me visualize the room much easier. And the easier you can imagine the space with your design, the more you can do.”

-Dan

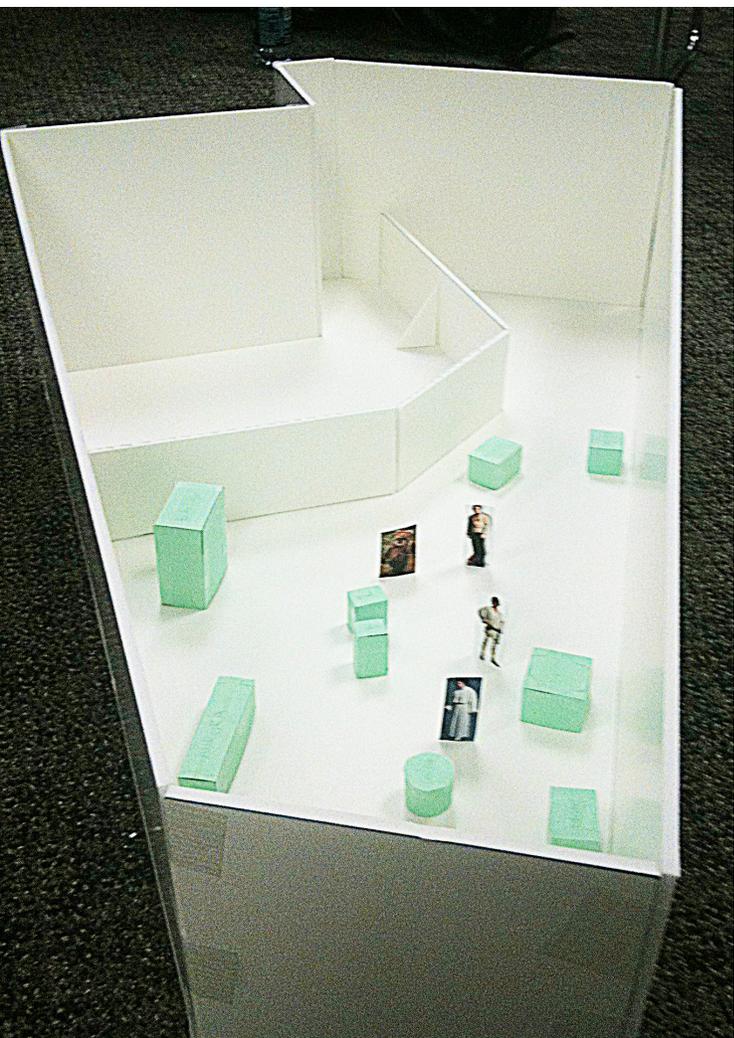


Figure 6

This is the scale model of the exhibition room made out of foam board.

Comment 30

“The second field trip to Thanksgiving Point was amazing. We had worked so hard to understand the content and the exhibits that everything just came together so quickly. We knew that we wanted an “outdoor” type environment, but when the bedroom/backyard idea came up it was like the floodgates opened and everything fell into place.”

-Carrie

walk into this family’s backyard and see all the fun exhibits they had built as they experimented with light? That was it! It came like a revelation. Suddenly all the class members converged on the same *shared vision* (Bucciarelli, 1994, p. 159). This was the coherent framing idea they had been looking for. Once again the ideas started flowing. Details for the exhibits, decorations, and even this family’s bedroom originated at that very moment (see [Comment 29](#), [Comment 30](#), and [Comment 31](#)). As will be further explained in the next section, it was hoped that this new narrative would be

tive, but none of them felt right. There were many questions left unanswered by the model.

The class therefore determined it was time to visit Thanksgiving Point again to see the Discovery Room in person. The class had been there before at the beginning of the semester, and the team leader who worked for Thanksgiving Point had tried to remind the class members what it looked like, but circumstances merited another trip. This was one of the best decisions that the class made.

When the class arrived at Thanksgiving Point, they were now equipped with an understanding about light and space exploration, they had brainstormed and researched myriad ideas for the space, and they had worked with the scale model of the room. Viewing the exhibition space in the actual room this time was like seeing it again for the first time. The class members were able to walk through the physical space, pointing to objects or walls as they continued to discuss ideas that had been conceived in class, which now took on dimension (see [Comment 28](#)).

As the class walked through the Discovery Room someone had an idea. What if guests were to walk into a children’s bedroom where they were able to get to know the children and their family?

Then what if you could

Comment 28

“Our lenses had changed since our first visit. We now had a clear understanding of the subject matter. We had a reservoir of ideas. And we had purpose. Walking around the entrance, we did not anticipate the exciting design event that was about to unfold.”

-Anne

Comment 29

“To this day I can’t remember who it was that made the initial suggestion to turn the Discovery Room into a bedroom and backyard. I think that’s because the idea seemed to take hold so strongly on all of us. It was as if it was an idea that had come to everyone at once. It helped me to see how important our team as a whole became.”

-Stephen

Comment 31

“With the suggestion of a bedroom and backyard, it truly did feel like the team was acting as one mind and body. The creativity continued to flow as we worked our way around the room; we could see in our minds’ eye the finished product. After we returned to the classroom it also appeared that we could work through constraints and design problems with greater ease. We had a greater awareness of the world we wanted to create and how we hoped the visitors would interact with it.”

-Richard

appealing for the families that visited Thanksgiving Point.

Had the design class not gone back to Thanksgiving Point to see the exhibit space again, it is unlikely that they would have been able to create such a compelling and unifying narrative. It is also important to note that the inspiration for the design did not come until after weeks of hard work. Both the preliminary work and repeat visit were necessary (see [Comment 32](#)).

The Narrative: Meet the Andersons

The framing for the design coherence had taken shape. Now a compelling narrative was needed to draw visiting families into the experience. The class knew that families from the surrounding Salt Lake and Utah Valleys were the primary audience of Thanksgiving Point. As such, the class determined that when guests walked into the Discovery Room they would venture first into a children’s bedroom and then in their backyard. The guests would then be able to view the exhibits as they had been set up and explained by a family. This was the birth of the Andersons. If this exhibit space was to come alive, then the family that guests would be meeting needed to be believable. The hope was that guests young and old would relate to one or more members of the Anderson family, thus helping them have a more meaningful experience with the exhibits.

The design class felt that the emphasis needed to be on families, and particularly on children, who are a primary audience of Thanksgiving Point. The class determined that Skyler (boy, age 8) and Aurora (girl, age 11) would be the children of Mr. and Mrs. Anderson (see [Comment 33](#) and [Comment 34](#)). Together the family loves to play, explore, create, and learn (see Figure 7). They decided to turn their backyard into an observatory, where they could invite all their friends to come and explore with them. In their backyard guests could learn all about light and how it helps us to understand

and explore space. Skyler was invented as a bit of a book-a-holic, who loves science. It would not be at all odd to find him dressed up like an astronaut pretending that he was on Mars. Aurora was conceived as much more artistic and creative. She enjoys socializing with others. Together Skyler and Aurora make a great brother-sister partnership.

When guests walk into the Discovery Room they actually walk into Skyler and Aurora’s bedroom (see Figure 8). The design class decided on a bedroom for a number of reasons. Bedrooms have personalities that reflect the people that live in them. A bedroom can be decorated with pictures, posters, and other fun artifacts. The goal was to place artifacts in the room that would repre-

Comment 32

“Having a 3-D model really helped to visualize the space, but I had to actually go there to see what’s actually possible. So, we needed both the model and actual experience with the room to design what we have designed. This kind of specific and concrete visualization is a key to success.”

-Isaku

Comment 33

“We did spend significant time (about three class periods) working on creating the personas for these characters. We asked each other what each member would be like. Aaron and I both made proposals and the class came up with the names based on the personas we collectively developed.”

-Keith

Comment 34

“The class felt it was necessary to write the back story for the Anderson family. They were encouraged not to take valuable time doing so by their professor. However, it was key for the class to understand these folks that had turned their backyard into this amazing destination that they wanted to share with the rest of the world...With this foundation in place, the children’s bedroom and the family’s backyard began to come alive and reflect their personalities.”

-Aaron

Meet the Andersons

They'll be guiding you through the exhibit.

Most of what we know about space comes from studying light.



Mr. Anderson
I guess you could say that we're just your average family, except we love learning about science and space. Much of what scientists know about space comes from studying light, so we think of our backyard as the first frontier for our family's dreams of space exploration.



Aurora
If you have more questions, find one of the Thanksgiving Point staff people and they'll investigate the answers with you.



Mrs. Anderson
Explore the amazing world of light with our future scientists, Skyler and Aurora. Open things up, look underneath tables, and be sure to try all of our fun and educational experiments. Skyler and Aurora will tell how they've tried the experiments and Mr. Anderson and I will explain some of the reasons things are happening.



Skyler
And don't forget, there are lots of other things at Thanksgiving Point to help you learn all about space: a solar system walk, a space garden, and more.



Made possible by generous support from NASA

THANKSGIVING POINT
NASA BLAST
BRINGING LIGHT AND SPACE TOGETHER

sent children that love to discover, and learn, and have fun all at the same time (see [Comment 35](#)).

Comment 35

“As our focus was on designing for families we decided that we would make some of the artifacts hands-on. We made plans for LEGOs and an interactive computer on Skyler’s desk.”

–Stephen

Comment 36

“The Andersons made the exhibit so personal to the patrons and created an amazing medium for us to create a great environment.”

–Carrie

the exhibits would seem like they belonged in a backyard. For example, an exhibit might be placed into a flowerbed, it might have a metal shell put on the top of it to make it look like a barbeque grill, or there might be a tent or two with fun experiences waiting for guests inside (see [Comment 37](#)). It was assumed by the design class that a compelling narrative and proper design that focused on a realistic family would draw families into the experience and would promote real

of Albert Einstein or a model of Skyler’s favorite Star Wars characters. You might see Aurora’s art kit, or maybe her telescope (see [Comment 36](#)).

When guests venture into the backyard they are able to see some of the handiwork of the Andersons. The design class knew that the exhibits from the Exploratorium would be professionally built for generic contexts. To integrate these into the Anderson’s backyard, the idea was then to put facades on the exhibits to make them appear as if a family with ordinary skills had put the exhibits together themselves. It was also hoped that



Figure 8

This is the bedroom of Skyler and Aurora Anderson that guests walk into.

Figure 7

This is a picture of a graphic that introduces guests to the Anderson Family at the entrance of the *NASA Blast* exhibition.

Comment 37

“This is where I really had fun being ‘the experimenter’. I brought in beach balls, brooms, flowerpots, etc. The two exhibits I was working on had to do with our eyes and how they interpret the light so we can see. One of my ideas was to have had Skyler and Aurora make a giant representation of eyes and glasses using the beach balls for the eyes and foam water noodles structured into the glasses. Although this idea was not carried out, I do believe it helped us facilitate other ideas for possible experimental artifacts that could have been found in someone’s backyard.”

-Anne

parent-child learning interactions, which was one of the goals of the project from the beginning (see [Comment 38](#)).

Influencing a Change

Never before had Thanksgiving Point designed an exhibit space with such an extensive narrative (see [Comment 39](#)). As all of the designing and planning was taking place for the new light exhibition, the Discovery Room was already the home to another exhibit about motors, magnets, and perceptions. These exhibits had been placed throughout the Discovery Room as stand-alone exhibits. Nothing had been done to create a narrative or design coherence among them. This was originally done purposefully (see Figures 9 and 10). Thanksgiving Point wanted the focus to be on the exhibits and not the surrounding space (see [Comment 40](#)). It was supposed that the exhibits, by themselves, were compelling

enough, and that nothing further was needed to elicit guest interest. While some of the isolated exhibits did engage visitors, observations of traffic patterns showed that the room lacked drawing

Comment 38

“Our goal was to have guests forget they were in a museum. We wanted it to look, feel, sound, and even smell like a backyard.”

-Stephen

Comment 39

“Again, this narrative is a central principle in the design process that we used.”

-Aaron

Figure 9

This is a picture of the Discovery Room *before* the *NASA Blast* exhibition was created.

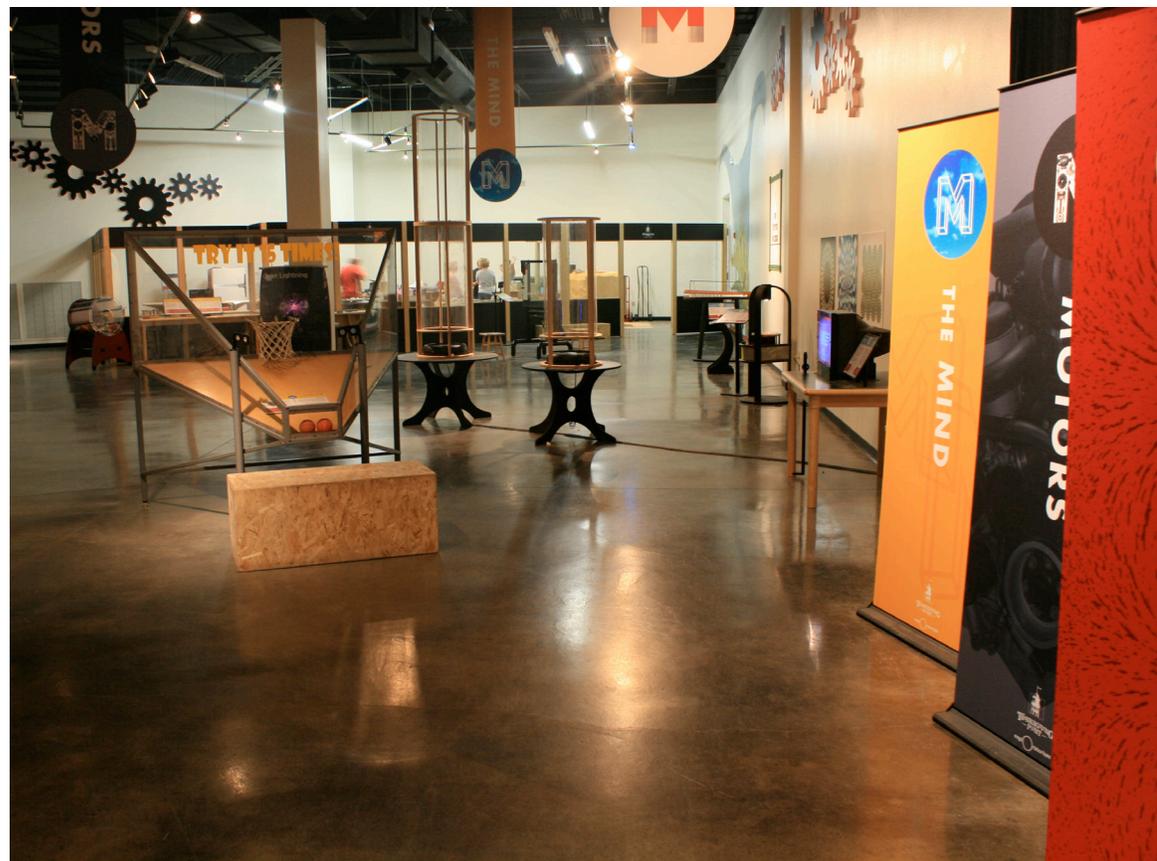




Figure 10

This is a picture of the Discovery Room *after* the *NASA Blast* exhibition was created.

power and coherence. The design class saw this and wanted to create a narrative that would not only improve the visitor experiences for the upcoming exhibits but would also influence the way Thanksgiving Point designed exhibitions in the future.

At length the design class set up a meeting to present their ideas to the Thanksgiving Point senior management. During the presentation the class members emphasized the following points:

- The “backyard” narrative and focus on the Anderson family would be more appealing and attractive for visiting families than the random placement of the stand-alone exhibits as had been done before.
- If this design was successful it provided Thanksgiving Point with a springboard for helping create other exhibitions in the future (see [Comment 41](#)).
- Because it was still unclear whether NASA would fund the project, a lighter, less costly version of the same narrative was also proposed.

Comment 42

“I greatly appreciated Thanksgiving Point’s confidence in us. Their enthusiasm and validation made this experience so meaningful to me.”

-Carrie

The senior management caught the vision of the design, expressed their enthusiasm for the project, and gave it their full approval (see [Comment 42](#)). They were especially excited about the Anderson family. They liked the ideas so much that they integrated the Anderson family property-wide (see [Comment 43](#)).

Comment 40

“I think this might have been why the room felt so much bigger than it was the first time we were there. But once we realized how much stuff we wanted to put into the room we realized some of our space limitations.”

-Dan

Comment 41

“This was a critical piece of our thinking. We continually talked about providing Thanksgiving Point with a product that they could use for years to come in the Discovery Room. Our design work was influenced by this goal.”

-Aaron

Comment 43

“This was one of the lasting legacies we had hoped for.”
–Aaron

The Anderson family was no longer just associated with the light exhibition, but they would also be included in other NASA-related activities and exhibits throughout the Thanksgiving Point property, which included a solar system walk-through in the Gardens, and the growing of “space plants” in Farm Country (see [Comment 44](#)).

The Explorer’s Guidebook: A Lost Feature

Beginning with the brainstorming sessions at the start of the semester, the class wanted to create an instructional medium that would lead visitors through the exhibition. Eventually it was decided to create an explorer’s guidebook, with the Anderson family as its authors.

Upon entering the Anderson’s home, guests would receive a guidebook. Guests could then read comments from the Anderson family about the purpose of their backyard, additional explanations about the exhibits, and clues for finding hidden treasures throughout the exhibition. This guidebook would also provide families with pre- and post-museum visit activities that could be done at home, including web resources.

The design class started prototyping ideas for the guidebook which included making it look like a regular scrapbook, using handwritten typesets for each Anderson family member, and even turning it into a smart phone application.

Comment 45

“For me this was one of the most difficult design ideas to give up. I felt that it had the potential for helping guests to get the most meaning out of each exhibit.”
–Stephen

The biggest drawback to the explorer’s guidebook was the cost associated with it. The project was already moving forward on a very limited budget. If the guidebook were to come to fruition it would need a sponsor. Unfortunately no sponsors were able to be contracted, so the explorer’s guidebook fell by the wayside (see [Comment 45](#) and [Comment 46](#)).

Comment 46

“It didn’t ‘fall by the wayside’, it was completely eliminated. This was a major disappointment for me too.”
–Keith

The Completion of the Class and the Beginning of the Building

After many long weeks of intense work the semester came to a close. The allotted time that the design class had agreed to help was up. Two members of the design class decided to continue working on the project. Around this time wonderful news came in: NASA decided to award the grant to Thanksgiving Point. This made more funds available for the building of the exhibition. The exhibition was also given its official name: *NASA Blast: Bringing Light and Space Together*.

The end of the semester became a transition time. Many of the instructional ideas and designs that had been created by the class were passed on to the Thanksgiving Point marketing department (see [Comment 47](#)). They were responsible for all the instructional graphics and interpretive materials. The exhibition department at Thanksgiving Point

Comment 47

“This was a challenging time. We knew that all of our ideas would not make it into the final exhibition; that was clear. It was hard to hand the work off to a team that had had much less exposure to the design problem. We were worried that they would decide to do their own ideas that were not founded on the semester-long work and research we had done. We did our best to express our ideas to them in a comprehensive design document.”
–Stephen

led the way in building the facades of the Exploratorium exhibits, making them appear as if they belonged in a backyard. They also built all the artifacts for the theme, such as the Anderson children's bedroom, the walls of the house, and the decorations for the Anderson's backyard (see [Comment 48](#)).

The Opening of *NASA Blast* and Informal Evaluation

On July 1, 2010, *NASA Blast* opened up to the public (see Figures 10 and 11). It was received very well by Thanksgiving Point guests. The design class and Thanksgiving Point staff observed that children enjoyed participating in the activities in the Anderson children's bedroom and in the exhibits in the backyard. Parents appreciated the appeal that the immersive environment gave. Families explored and played together. Thanksgiving Point stakeholders were also happy with the friendly, yet professional feel of the exhibits.

According to an informal evaluation, conducted internal to Thanksgiving Point, guests felt that the theming and environment did make a difference in their experience. Twenty people were randomly selected to participate in an exit survey. When asked to rate how important the theme/environment is in an exhibition the guests gave an average rating of 8.5 out of 10, 1 being not important and 10 being very important. When asked if they would recommend the *NASA Blast* exhibition to a friend or family member, visitors gave an overall average rating of 8.9, 1 being very unlikely and 10 being very likely. Visitors gave an average overall rating of 8.9 when asked

Comment 48

"The clients asked us not to think about the budget as we were designing the exhibit. We knew many of our ideas would require significant funds, but the clients assured us that they would be able to figure things out. In the end, I was quite pleased with how many of our ideas were realized."

-Carrie



Figure 11

This is another view of the Anderson backyard from the rear of the *NASA Blast* exhibition.

how likely they were to visit the exhibit again, 1 being very unlikely and 10 being very likely. The guests also rated their overall experience in the *NASA Blast* exhibition as a 9 out of 10, 1 being poor and 10 being excellent (King, 2010, p. 21-22). From the evaluation it is unclear how much of the guests' overall experience was affected by the design of the narrative and theming as opposed to other factors such as the exhibit content and staff interaction.

Naturally not all the ideas generated by the design class were included in the final exhibition. Some ideas were cut due to time and money constraints. The following are some of the most notable subtractions from the original design ideas.

Discourse. In retrospect, the design class observed that they were able to influence the discourse of some groups, but perhaps not to the extent they had hoped. The discourse of the class members was definitely altered. The class, as a community, was introduced to new terms and meanings through the semester; they even created some of their own. By the end of their time together they communicated with one another as if those terms and meanings had always been second nature. It is unclear if the discourse of the visitors was changed. According to informal observations made by the Thanksgiving Point museum staff, more parent-child interactions have been observed since the opening of the exhibition. However it is unclear if the visitors have left the exhibition feeling empowered to conduct their own experiments and make their own discoveries at home. Whether the discourse of Thanksgiving Point has been changed remains to be seen, particularly when new exhibitions are developed.

While the class did not achieve the highest discourse changes they were hoping for, they likely reached the status of project (Krippendorff, 2006). Projects require the collaborative work of many people. They “always proceed in language, in narratives of what has to change, needs to be done, how, by whom and at which time” (p. 10). A designer may try to dictate all the instructions of what should happen, but the process becomes much more robust, thus requiring the help of many others to make it successful. In short, the design class effectively used the resources of many individuals to create meaningful experiences for Thanksgiving Point guests, but they did not necessarily cause a change in the way people perceive Thanksgiving Point or its venues (see [Comment 49](#)).

Subject matter. The design class spent an extensive amount of time making connections between light and space exploration. Great detail was laid out in a design document, given to Thanksgiving Point, which showed how these ideas could be represented to visitors. Unfortunately the connection with visible light to the electromagnetic spectrum for understanding space exploration was never fully incorporated. The design ideas were turned over to a production group that had not been privy to the discussion of the subtleties of the subject matter. Consequently the plan for the interpretative materials was changed considerably. This resulted in the exhibits being focused heavily on the principles of visible

light and less on the relationship between light and space exploration (see [Comment 50](#)). An introductory graphic was created, however, that explains how much of what we know about space comes from light (see Figure 7).

Looking back this was a major design failure on the part of the design class. The class assumed that the design document would be a sufficient medium for passing their ideas onto the other production groups. Had the design class met personally with all the members of the other

Comment 50

“At times this problem has been resolved through staff facilitation. But we still wish it were more apparent throughout the entire exhibition.”

–Stephen

Comment 49

“Given more funds, resources, and time, I believe we were capable and prepared to design to the discourse level. We had developed the skills and processes to do so. Not reaching the discourse level was more happening of given limitations.”

–Anne

production groups who were responsible for the final design and production of the interpretive materials, the class could have more effectively solicited their design ideas. The resulting interpretive graphics could have been very different.

Interpretive panels. Additionally the design class had hoped that the instructional panels at each exhibit would be much more graphical. Many interpretative text panels are present throughout the exhibition. While this is helpful, the design class wanted families to learn by doing. A set of pictures could simply and effectively show guests how to manipulate the exhibits. Instead guests are required to read through paragraphs of explanations. Again, the design class could have expressed their ideas for the interpretative panels more effectively by personally meeting with the other production teams.

Conclusion

It is unclear whether the new exhibition space that was created has made a difference for any of the visitors. However, it has provided guests with a place where they can bring their families and interact with one another in meaningful ways; and exhibitions that are designed in the future will have this predecessor's narrative, theme, and meaningfulness to try and emulate.

This design case study has also sought to describe how a team of novice designers approached a design in a non-procedural way. This article tried to make plain the thinking patterns of novice designers under conditions when the familiar props to design process have been removed. The key learnings from this experience included discovering the importance of driving to the heart of the subject matter; developing a situational design process; understanding the type of artifact being designed, in this case a discourse or a project, according to Krippendorff (2006); and achieving design coherence by using extended periods of uncertainty before allowing the design to coalesce.

References

- Brooks, F. P. (2010). *The design of designs: Essays from a computer scientist*. Upper Saddle River: Addison-Wesley Professional.
- Bucciarelli, L. L. (1994). *Designing engineers*. Cambridge: MIT Press.
- Friedman, A. J. (2008). Framework for evaluating impacts of informal science education projects: Report from a National Science Foundation Workshop [Electronic Version]. Retrieved October 6, 2010, from http://informal.science.org/evaluations/eval_framework.pdf
- Kelley, T., & Littman, J. (2001). *The art of innovation: Lessons in creativity from IDEO, America's leading design firm*. New York: Doubleday.
- Kelley, T., & Littman, J. (2005). *The ten faces of innovation: IDEO's strategies for beating the devil's advocate & driving creativity throughout your organization*. New York: Doubleday.
- King, W. (2010). Museum of Natural Curiosity education plan. Unpublished Internal Report. Thanksgiving Point Institution.
- Krippendorff, K. (2006). *The semantic turn: A new foundation for design*. Boca Raton: CRC Press/Taylor & Francis.
- Reigeluth, C. M. (1999). The elaboration theory: Guidance for scope and sequence decisions. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2). Hillsdale: Lawrence Erlbaum Associates.