New Amusement Rides: platforms for parents and children to share fun

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For my parents

Abstract

Since Bakken, the world's first amusement park, opened in 1583 at Klampenborg, Denmark [1], amusement parks have become a fun place for people to spend quality time with family. Early versions of American amusement parks in the United States entertained patrons by providing picnic groves, concert halls and events like fireworks. However, with the rapid evolution of technology, the primary characteristic of many of today's parks are rides which are, first and foremost, breathtaking. In other words, amusement parks tend to gratify a desire for thrills rather than provide a space for parents and children to enjoy spending time and playing together.

My thesis proposes a way to make the amusement park a place for play where parents and children share fun together. I design two rides which target six- to twelve-year-olds and their parents, and enable them to positively interact and collaborate with each other. After conducting research, including field trips to experience firsthand current amusement rides, a study of middle childhood development, and a questionnaire collecting people's perception of play, I design Carstruction and Spacejump to satisfy people's desire for true play. It is my intent for riders to play an active role and provide certain interactions between the riders in order for the ride to function. This cooperative dynamic encourages child development as well as parent-child relationships. Operating instructions and computer-generated scenarios are illustrated, and a semi-scale mockup of a ride is fabricated for an evaluation of its feasibility in terms of technology, marketability, and legality. Following a trial ride, users' feedback is documented and inspires future design revision.

Contents

List of Figures

Chapter 1 Introduction

> *Play can occur only in a condition of freedom, because it is above all doing what you want to do, when and where you want to do it.*
>
> – Richard Dattner [2]

Amusement park is the generic term for a collection of rides and other entertainment attractions assembled for the purpose of entertaining a large group of people [1]. My thesis project designs two unique amusement rides as a platform for parents and children to share fun. My thesis contains the following: an overall introduction that includes a problem statement and the objective of this thesis; a research plan that includes field trips, childhood research, and a questionnaire; then newly designed rides, a fabrication of a ride, and finally, the conclusion.

1.1 Inspiration

In the summer of 2009, Prof. David Morgan invited me to his home, and there was a trampoline in his backyard. His children invited guests to join their bounce game in which people circled the perimeter and jumped simultaneously to launch a person sitting at the center on the trampoline (Figure 1-1). I was impressed by the simplicity of the game and noticed that both adults and children were entertained and having fun. Several pictures popped into my head and ignited my curiosity. I kept thinking, “when children and parents jump and tumble on the trampoline, what makes them laugh so heartily and feel so close?"

Figure 1-1 People of all ages enjoy the bounce game on a trampoline in Prof. David Morgan's backyard.

During that same summer, as a roller coaster fan, I went to Cedar Point Amusement Park in Sandusky, Ohio, to ride the new roller coaster. Top Thrill Dragster is an extremely thrilling ride with a 420-foot height, and a maximum speed of 120 mph. Even though I was nervous and excited waiting in line, watching riders scream, after taking the ride myself, I realized that while there was 20 seconds of 'awesome,' the overall experience was not one of delight. This reaction was not what I had expected. I kept asking myself whether higher and faster rides, even with their massive applications of advanced technology, really satisfy children's desire for true play?

Figure 1-2 On my field trip, I ride Top Thrill Dragster at Cedar Point Amusement Park.

1.2 Problem Statement

An amusement park is conventionally a venue for people to have fun and make special family memories. However, nowadays amusement parks by and large focus on people's desire for thrills as evidenced by the proliferation of breathtaking and exciting rides. As a matter of fact, 79 new roller coasters were built and operated all over the world in 2010 [3]. From my new perspective, it seems that conceiving and designing amusement rides based on parents and children's desire for play is the first step toward improving the atmosphere of current amusement parks.

Despite the trend toward exciting mechanical rides, I challenge the notion that high-tech rides are really close to a child's true dream of play. On the contrary, a child spends a whole afternoon using a simple plastic shovel and bucket to play with sand in the backyard. What delights them so much that he/she never wants to stop playing? Even without advanced technology, I contend that a simple ride, whose features exactly match people's desire for play, can touch people's hearts.

Furthermore, interaction is the key both to improving the enjoyment that people experience from their products and to facilitating the formation of personal memories connected to the products, both of which can increase the degree of the attachment that people experience with the products [4]. However, most of today's amusement rides are passive in nature providing fewer connections and interactions with riders. The degree of this passivity means riders will have predictably less fun and form fewer memories. Thus the question: Is it possible to design an amusement ride that enables participants (both children and adults) to play a more active role, thereby heightening parent-child interactions, resulting in stronger feelings and fonder memories from play?

1.3 Objective

The objective of my thesis is to provide new amusement rides, which will enable parents and children to play and share fun together. Possessing little advanced technology, the new amusement rides, with simple mechanisms, will be safe, unsophisticated, and come closer to fulfilling people's desire for play. Meanwhile, parent-child interactions and peer interactions, elements vital to the parent-child relationship and child development, will occur more frequently because of the need for more conversation, collaboration, and physical touching during the ride experience. I also hope that this thesis will generate interest in providing another direction for amusement ride design, and that future amusement parks will be places where people love spending enjoyable family time together.

Chapter 2 Research Plan

> *Fun is a key element in people's conception of play and their choice of play. One of the aspects of play that made it fun was a certain level of active participation.*
>
> – Elissa Miller & Heather Kuhaneck [5]

A design process is my thesis guideline. One of the major parts of the process is a research plan, which generates an idea followed by a design. The goal of the research is to first delve into the rationale of people's choices of play in order to identify the key element which will be applied to the ride design.

2.1 Design Process

Figure 2.1 is the design process diagram of my thesis. The project starts with the problem statement, the objective, and the target user definition aforementioned in Chapter One. Then I conduct an investigation of current amusement rides and a comprehensive study of children's museums. Meanwhile, I research papers and documents to gain an understanding of children in middle childhood, the target users of my amusement rides. The comprehensive research plan and its outcome raises a key question: what are people's perceptions of play experiences and play preferences? A questionnaire based on this core question is created to collect people's firsthand experiences. Not only is the aforementioned research essential to concept formation, but the correlative mechanical knowledge is also required for design construction. Both proposed designs, Carstruction and Spacejump, are the basis from which I iteratively go through every step of the design process, refining my concept along the way. The Spacejump mockup is then built to test feasibility in terms of technology, marketability, and legality. In the future, design improvements will be based on users' feedback.

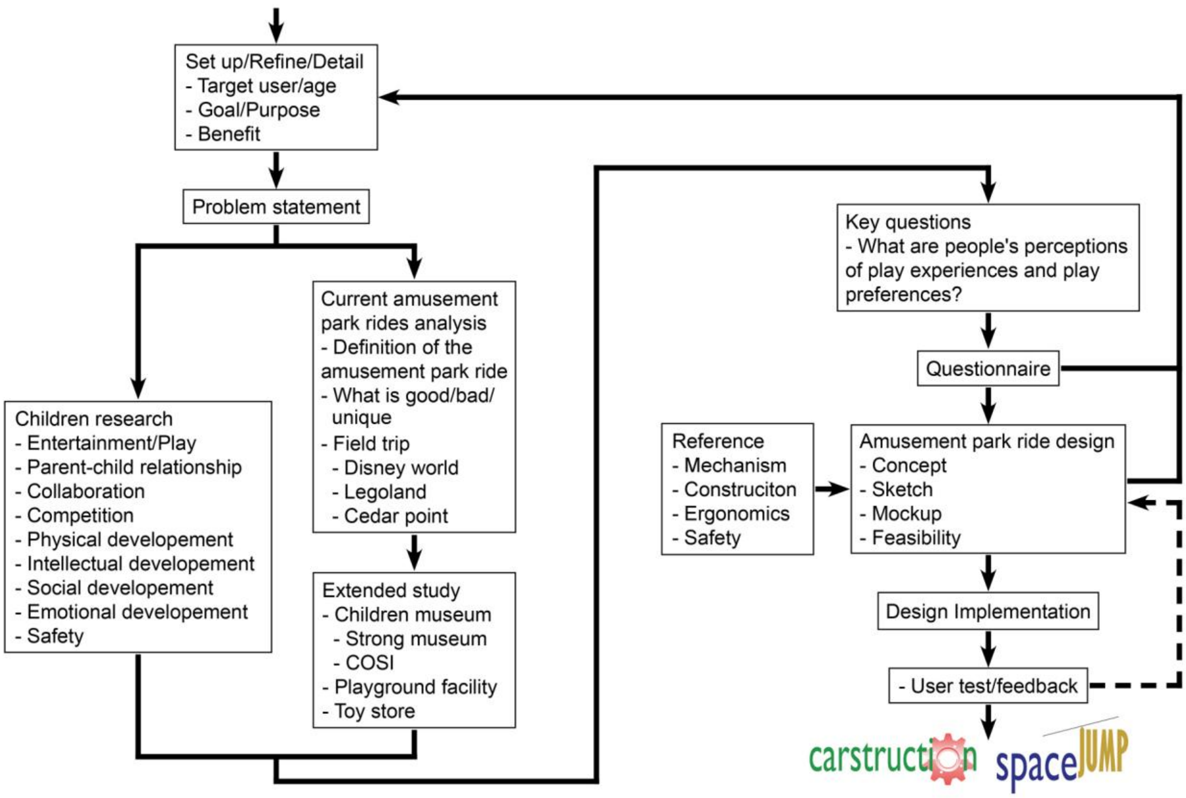

Figure 2-1 This figure displays the design process of my thesis.

2.2 Research Plan

There are three parts to my research plan: an analysis of current amusement rides combined with a comprehensive study of children's museums, a study of children's behavior in middle childhood, and a questionnaire.

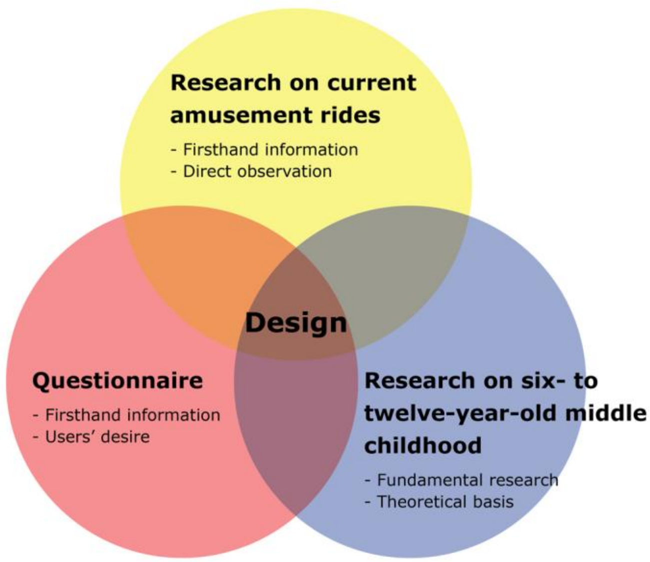

Figure 2-2 The research plan has three major parts.

2.2.1 The Research on Current Amusement Rides

This study's goals are to understand the characteristics of current amusement rides and the direction of ride development, to categorize rides and, most importantly, to experience these rides. In the past two years, I visited many amusement parks including Disney World in Orlando, FL, Cedar Point in Sandusky, OH, and LEGOLAND in Billund, Denmark, to closely observe some of these remarkable rides. The keynotes made during these visits are summarized as follows:

Date: August 2009

Name: LEGOLAND

Location: LEGOLAND ApS, Nordmarksvej 9, 7190 Billund Denmark

LEGOLAND is Denmark's most popular amusement park. What sets it apart is that more than 58 million LEGO bricks were used to build all of its models [6]. Lego is a popular brand whose toys are sold world-wide, making them the best advertisement for LEGOLAND, but there are plenty of impressive and enjoyable rides too. Two amusement rides struck me as particularly fascinating:

✧ Ride: Pirate Splash Battle [7]

Getting wet is a big part of the fun on Pirate Splash Battle as boat riders and people on shore use water cannons to splash each other. The most attractive and fun part of the ride is that riders on the same boat unite against a common enemy: other people spraying water at them. The ride is also family friendly with ample seating and a slow enough speed for youngsters' safety. I saw a father with children small enough to carry who enjoyed the ride so much that he took it repeatedly, evidence that adults enjoy this ride as much as kids do. The merit of this ride is the opportunity for both parents and children to share fun together.

Figure 2-3 On Pirate Splash Battle, a father (wearing white T-shirt) and his small children enjoy the ride repeatedly.

✧ Ride: Falck Fire Brigade [8]

This ride lets a family or a group of people play as a team of firemen to put out an imitation fire. One of this ride's distinctive characteristics is its maneuverable parts. Riders use manual power to propel the fire engine forward and spray water on imitation flames. Some people perceive the ride as a sort of race and want to be the fastest among eight groups to extinguish the 'flames;' others simply enjoy the fun of cooperating with family or friends to complete the job. Whatever the motivation, participants surely enjoy this ride. I was impressed because this popular ride does not use advanced technology, employing only manual running gears, controllable gadgets, and a meaningful goal. There are only a few rides like this that provide families a chance to work together in an amusement park.

Figure 2-4 Foreground, even big kids enjoy playing Falck Fire Brigade. Background, parents and their child cooperate, and have fun together.

Date: May 2009

Name: Cedar Point

Location: One Cedar Point Drive, Sandusky, OH 44870, U.S.A.

Cedar Point is my favorite spot to experience the newest technology in amusement rides. It is famous for its numerous roller coasters and thrill rides. My friend and I rode fourteen of the park's seventeen roller coasters. Roller coasters with different configurations and themes basically evoke the same mix of thrill and fright in me. Indeed, I find it also releases stress and gives me a feeling of detachment from the real world; however such complex feelings rapidly fade when the ride ends and later I am unable to share those detached feelings with my friends.

Figure 2-5 Cedar Point amusement park abounds with various roller coasters.

✧ Ride: Top Thrill Dragster [9]

Top Thrill Dragster held the world’s fastest roller coaster record from 2003 to 2005, and is still the fourth fastest of all roller coasters [3]. I was attracted by its fast acceleration which reaches a maximum speed of 120 mph in only 4 seconds, and its 420-foot drop back from the apex. I was excited while waiting in line, and enjoyed watching people being so nervous that they screamed before and after being launched. This ride seemed particularly hazardous because one’s body is so exposed while sitting on the ride, however the ride actually ran well and smoothly. It wasn’t too long after the ride though that I realized I was not impressed by anything other than the fast speed and far drop. For me, Top Thrill Dragster seems to be just another faster and higher roller coaster epitomizing today’s advanced technology.

Date: November 2008

Name: Walt Disney World Resort

Location: 4600 N World Drive, Lake Buena Vista, FL 32830, U.S.A.

Disney World is the world’s largest resort, encompassing four theme parks, two water parks, and twenty-three on-site themed resort hotels. It is designed to be an all-inclusive vacation resort. Below I list several key points based on my observations from the viewpoint of my thesis project.

✧ Theme

Based on Disney’s movies, songs and TV series, various themes provide entertainment in a fairy tale setting. Riders feel connected to rides because they have familiar themes, and this appeals to both adults and children.

✧ Imagination

The Disney experience provides not only physical installations to ride, it also enables you to live, if only temporarily, in a dreamland of imagination. People can escape from the stressful real world, and immerse themselves in a virtual and relaxing world.

✧ Interflow

The amusement park provides an atmosphere for people to express a range of positive feelings from anticipation (before the ride) to jubilation (at the ride’s end). Riders share their enjoyment with family and friends both on and off the ride. Even those who are not on the ride are affected by the joyful ambiance. I noted one key observation: the more exchanges of joyfulness and feelings between people, the merrier they are.

Figure 2-6 Cinderella’s Castle is one of Disney World’s most remarkable landmarks.

✧ Wide appeal

A family’s well-being is fundamental to the success of each of its members, and nothing promotes well-being more than experiencing happiness together as a family. The wider the age-range a ride accommodates, the more suitable it is for a family. Furthermore, parent-child relationships can be unconsciously improved by sitting side-by-side on a ride.

Figure 2-7 is a quadrant analytical diagram of current amusement park rides based on their characteristics. A passive ride means riders do nothing but sit on the ride. A mission-oriented ride means riders need to achieve a certain task with interactions among their peers as well as the facility to complete the ride. A maneuverable ride means riders can control and operate the ride by themselves. Currently, there are only limited maneuverable rides.

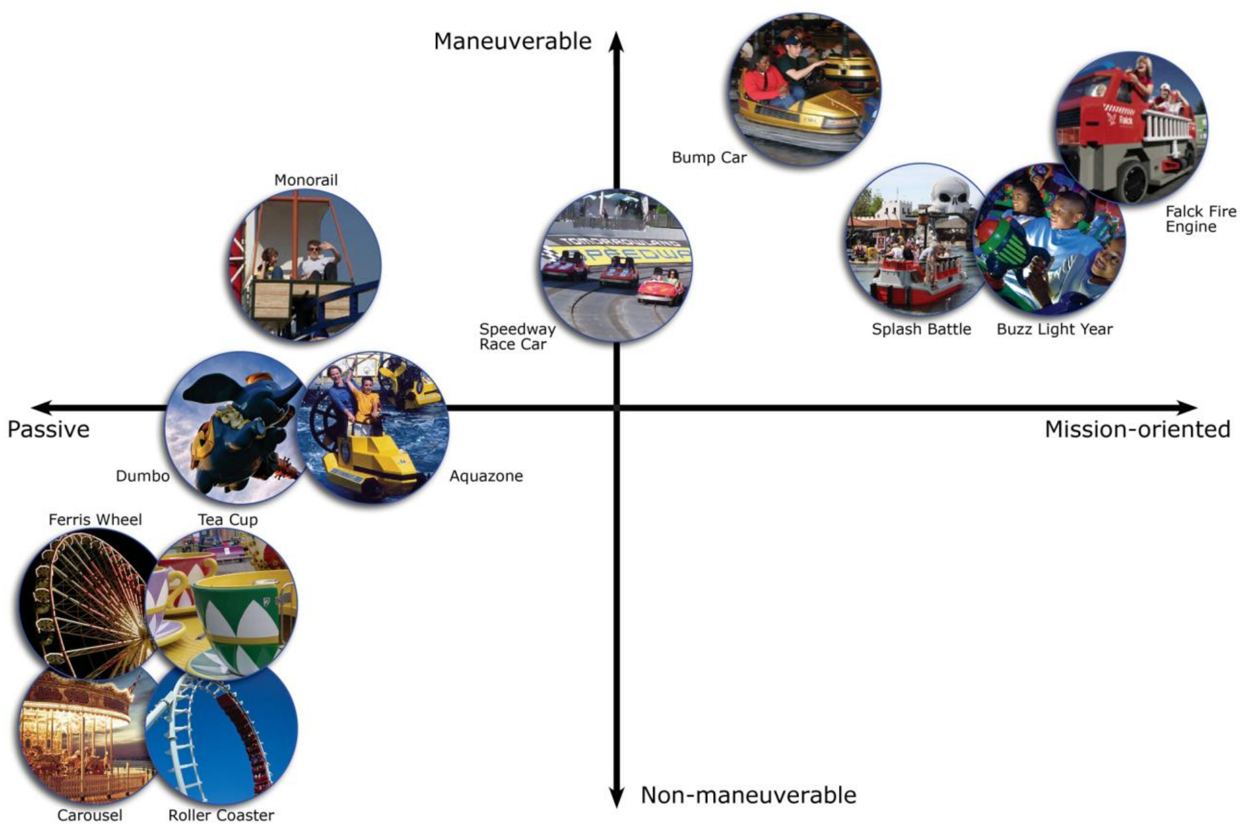

Figure 2-7 This quadrant analysis diagram assesses some current major amusement rides

Let’s think about some famous rides and where they are located on the diagram. The Ferris wheel, teacup, carousel, and roller coaster are passive and non-maneuverable rides. Dumbo can be maneuvered by riders to go up and down. The bumper car is the most maneuverable among current amusement rides. Pirate Splash Battle, Falck Fire Brigade, and Buzz Lightyear's Space Ranger Spin in Disney World are mission-oriented rides. Riders are encouraged or required to do something during the ride, such as shooting laser pistols to score or extinguishing an imitation fire by pumping water.

New rides seem to be trending toward designs that enable riders to play a more active role. Indeed, people appear to become much more involved and have interactions on mission-oriented and maneuverable rides. This was apparent to me during my amusement park field trips. My amusement ride designs will fall into the quadrant analytical diagram's upper right hand corner in that they are interactive rides.

2.2.2 Comprehensive Study of Children's Museum

In addition to researching amusement parks, I went to children's museums, not only to explore those appliances and activities designed for children, but also to observe children's play behavior.

Date: June 2009

Name: COSI (Center of Science and Industry in Ohio)

Location: 333 W. Broad Street, Columbus, OH 43215, U.S.A.

This is a museum for children to help them understand basic theories of science and industry through "hands-on" exhibits and informative and entertaining demonstrations. There is a big seesaw in COSI which demonstrates the lever principle. Children pull a rope at one end to lift an actual car at the other to understand this concept. At that time, I had already developed an idea that would become one of my amusement rides, Spacejump. The big seesaw's structure in COSI provided a good reference in the later fabrication of Spacejump.

Another exhibition in the center, The Science of Big Machines, was unprecedented. Children are allowed to complete a simple task by operating real construction machines accompanied by a licensed technician. The children were completely immersed in learning and controlling the operation. They all, both boys and girls, had big smiles after performing the task, and I realized that children are much more involved when they are allowed and encouraged to participate on a ride.

Figure 2-8 Photo at left displays one of the edutainment installations, on right, the Science of Big Machines in COSI.

Date: March 2010

Name: National Museum of Play

Location: One Manhattan Square, Rochester, NY 14607, U.S.A.

This museum is a toy gallery, as well as a place where children can experience many types of toys and play activities. There is a toy car assembly line where children cooperate together to practice assembling cars and then taking them apart again. They learn the essentials of teamwork through the process. Children may challenge themselves to assemble a car faster than the last time; however, they were easily bored as the process became routine. I realized that children love building, but creativity may be stifled by repeated tasks.

Figure 2-9 Many maneuverable and edutainment exhibitions are in the National Museum of Play. Photo at far left shows the toy car assembly line.

2.2.3 Middle Childhood Research

It is very important to understand target users' needs and desires before beginning to design. To know more about children between the ages of six to twelve years old, I studied several papers about middle childhood development. I summarized important points from those papers and adopted Debord's [10] method to separate them into three categories.

Debord's (1996) study found the following developmental aspects of middle childhood in social and emotional development.

- ✧ Children act nurturing and commanding with younger children but follow and depend on older children.
- ✧ Children are beginning to see the point of view of others more clearly.
- ✧ To win, lead, or to be first is valued. Children try to be the boss, and are unhappy if they lose. (p. 2)

The first two aspects show that children in this stage are able to cooperate. They listen, follow and have enough cognitive capability to figure out how to work with others. For example, children speak about shared decision-making, such as one of the situations in the experiment when children discussed play decisions together cooperatively before making those decisions [5]. The third point reminds me of the importance of avoiding a ride design that involves serious competition for riders, because nobody wants to think of him or herself as a loser after taking a ride. However, providing a just-right challenge in a play activity [5] while adding an intergroup competition [11] helps individuals enjoy the activity more.

Debord's (1996) study found the following physical developmental aspects of middle childhood:

- ✧ Children become almost as coordinated as adults by the end of middle childhood.
- ✧ Small muscles develop rapidly, making playing musical instruments, hammering, or

building things more enjoyable.

- ✧ Eyes reach maturity in both size and function. (p. 2)

The first point indicates that children can do some simple physical activities as well as adults. The second and the third points can be extended to mean that children in this age range are now mature enough to play games. They can also control and operate tools and gadgets better than ever. There exists a mild difference between boys and girls, however. In their research, Lindsey et al. found boys engaged in more physical play than girls [12]. Also, another study showed that boys used more physical behavior than girls, who for their part used more verbal behavior to get the job done in the experiment [13]. Even this distinction will be helpful for me in designing my amusement rides.

Debord's (1996) study found the following mental developmental aspects of middle childhood:

- ✧ Children learn best if they are active while they are learning.
- ✧ Children can talk through problems to solve them. This requires more adult time and more sustained attention by children.
- ✧ Children can develop a plan to meet a goal. (p. 3)

The first point clearly tells us how important it is for children to be active while they are learning. If we treat play as a kind of learning, active children will make the most progress developmentally through play. Moreover, the experiment shows that one of the aspects of play that makes it fun is a certain level of active participation [5]. The other two points state that children in middle childhood have better organizational ability. Moreover, De Jean et al. found in their experiment that both boys and girls enjoyed the game's cooperative play and group problem solving [14]. An important point is that parents play a key role: if more adult time is spent, better problem-solving ability will be built.

2.2.4 Questionnaire

I put together a questionnaire to collect firsthand information of people's perceptions and feelings of play. Forty-eight respondents from a range of ages and countries answer questions. According to the respondents' opinions, I discover people's desire for play and subsequently provide my design to meet their dreams.

In the questionnaire, the first section asks respondents how they felt about *play* between the ages of six to twelve. The second section asks respondents their current feeling about *play*. Here is the full questionnaire:

Section I (Please remember when you were six to twelve years old)

1. Please tell me about some of your favorite things to play with.
2. Why are those favorites? What did you like about them? What's special about them?
3. How did you decide what you did and didn't want to play with?
4. How do you remember playing with adults? Was it fun playing with adults?
5. How did boys and girls play the same or differently? Did you play freely with the opposite gender?
6. Who were your favorite people to play with? Why? (best friend, same age, neighbors…)

7. Where were your favorite places to play? Why?
8. Did you have a dream place (imaginary place) to play? Please tell me what it looks like.

   Section II

9. How do you play now compared with how you played when you were a child (six to twelve years old)? What is the same or different?
10. Imagine that in the future you have an eight-year-old daughter and a six-year-old son. How will you decide what you want to play with your children?

I summarize some useful data that later becomes the guideline of my design. When answering the questionnaire, sixty-three percent of the respondents said they enjoyed outdoor activities, while fifty percent enjoyed creative activities. Sixty-three percent of respondents answered that creative and buildable things were their favorite play objects, and twenty-five percent of respondents stated they liked some activities because they could play with friends. Fifty-eight percent of respondents gave negative answers when asked about playing with adults, and twenty-three percent of respondents preferred to play with children close in age. With this information there is certainly an opportunity for me to improve the parent-child relationship as far as play. Forty-eight percent of respondents felt free to play with the opposite gender, and forty-two percent of respondents did not. I kept this in mind so as to design a gender neutral ride. Eighty-five percent of respondents' indicated their favorite place to play was outdoors. This high percentage means that outdoor play is a fairly intrinsic desire for all survey participates.

I believe the questionnaire has given me good insight into people's desire for play. The results show that people prefer creative outdoor activities. Though children apparently like to play with peers, it is sometimes beneficial for them to play with adults. For example, Sargent writes in her book that parents can teach children and nurture their creativity through play [15]. Some special proposed play activities can help build healthy parent-child interaction, an essential element in a child's development [16]. Moreover, in most families, patterns of interaction between a parent and child are established in middle childhood. I believe amusement parks and rides can be an ideal medium for building a solid child/parent relationship. With the completion of this research, I challenge myself to design new amusement rides in order to provide platforms for parents and children to play together. I believe over time it will bridge the generation gap, especially as it pertains to play, and ultimately improve the parent-child relationship.

Chapter 3 Design

> *Whether planned that way or not, users will have some degree of experience from interacting with practically any object. The crucial thing is to both sustain and evolve that experience so that it is revisited and frequently re-evaluated by the captivated user.*
>
> – Jonathan Chapman [17]

This chapter introduces in detail two new amusement rides I designed to meet my thesis objective. The new amusement rides are a means for parents and children to play and share fun together. The details of the design include the core concept, dimensions, operating instructions, and computer-generated scenarios. These are summarized as follows:

3.1 Concept

Based on the research, questionnaire and my original goal, I form a clear and definite concept for my amusement rides, which is that they will be enjoyable, interactive, neutral, and widely appealing. They will also be equipped with maneuverable elements and provide skilled tasks with the just-right challenge that satisfies riders' intrinsic desires to have active roles in their play. The just-right challenge means activities will increase in difficulty as participants proceed through the steps. ‘Widely appealing’ refers to the fact that both children and adults participate in and enjoy the rides.

3.2 Dazzleland Amusement Park

Dazzleland amusement park is my dream amusement park, where parents and children play and share fun together. Carstruction and Spacejump are the first two rides I have designed for the park. In the future, I dream of making Dazzleland amusement park a real place where imagination and creativity thrive.

Figure 3-1 Dazzleland amusement park is a conceptual amusement park where parents and children play and share fun together.

3.3 Carstruction

According to respondents' answers, most people love creating and building things for their favorite play activity. I note this strong tendency and apply it to my amusement ride design. Carstruction is a pioneering edutainment-style ride during which people design and assemble the car they will be ride. Building a unique car could be as fun as riding in it, or perhaps even more fun.

3.3.1 Design Concept

Carstruction is similar to a train ride in that riders circle a loop in a railroad car. The railroad car has a chassis powered by paddle and a detachable body made up of construction bricks. The bricks come in a variety of shapes that are easily and quickly assembled and taken apart by special connectors. There are opportunities at the beginning for up to four riders to collaborate together to design and assemble their car. During the building process, riders discuss the plan, and help each other to put bricks onto the chassis.

I intentionally designed Carstruction as a family ride. Children are encouraged to play a leading role while building the car. They learn to work as a team, and foster peer relationships. Carstruction provides a just-right challenge for children, and they learn as they create. This is also one of the reasons to repeat the Carstruction experience. Parents enjoy participating in their child's play, and they interact with the child more in terms of playing a supporting role and providing necessary help.

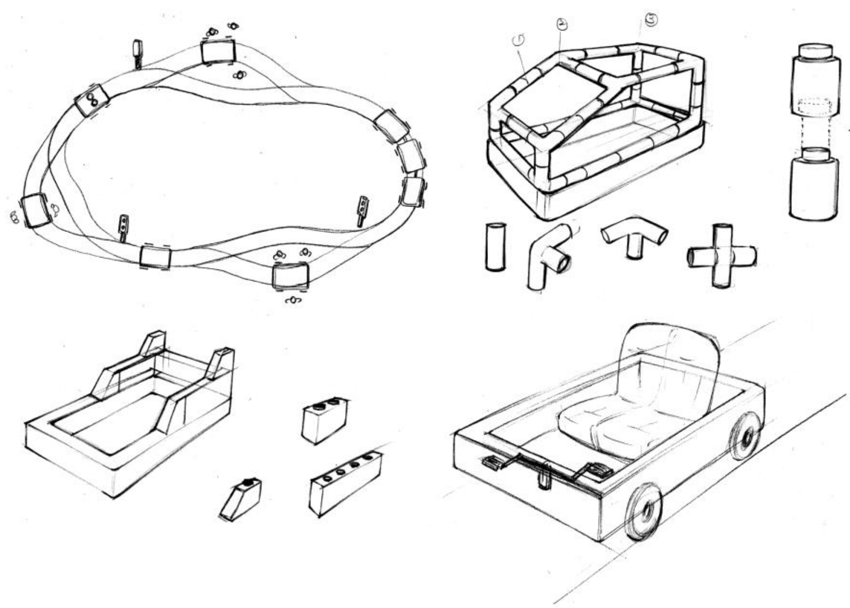

Figure 3-2 Above - The concept sketch of Carstruction.

3.3.2 Operation

Figure 3-3 shows the operation of Carstruction. First two to four riders cooperate at the building area before entering the main loop. They assemble bricks onto the chassis to create their unique car. After the car’s assembly, riders wait for a green light signal to enter the main loop. The ride is finished when the car completely circles the loop and returns to the area where it was first created. The riders dismantle the cars and return the chassis and bricks so the next group can play and build.

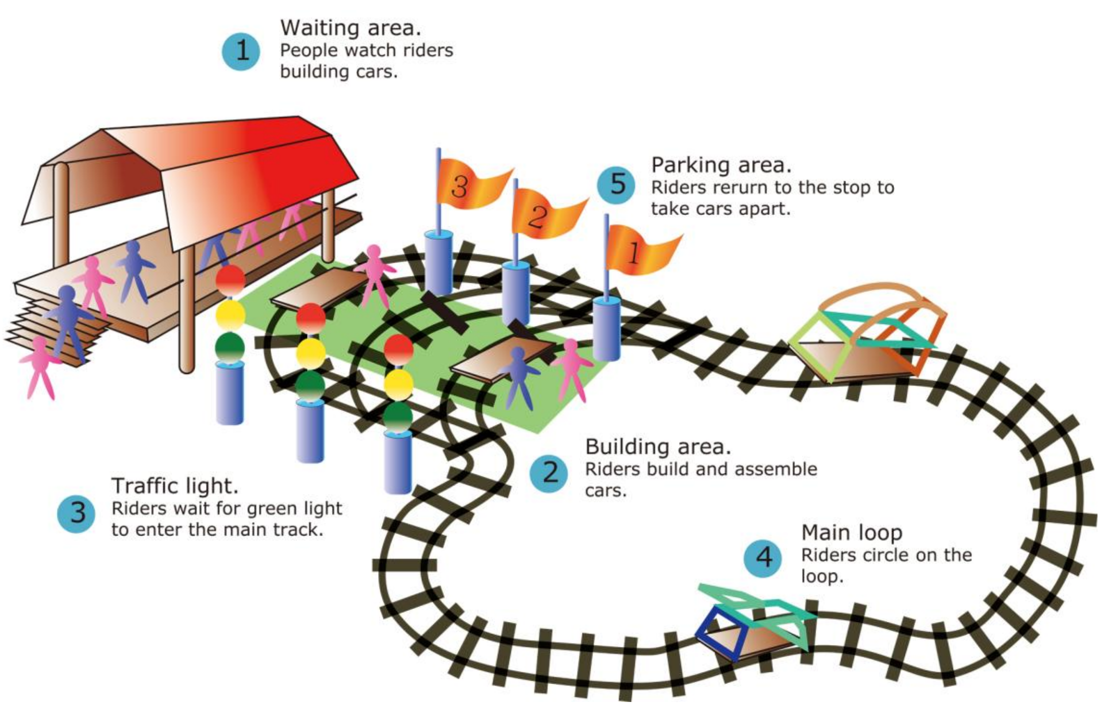

Figure 3-3 The operation diagram of Carstruction marks the five steps of the ride's experience.

3.3.3 Dimension

Figure 3-4 shows the dimension of the chassis and the bricks.

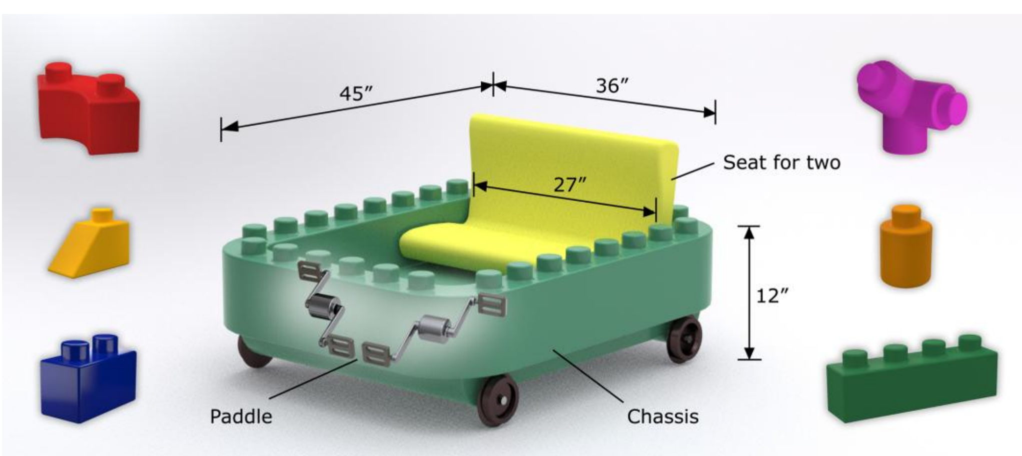

Figure 3-4 The dimensions of Carstruction and the bricks is pictured above.

3.3.4 Scenario Simulation

Figure 3-5 illustrates what happens while riders build their cars. Children lead and parents support the process. During the building, riders have conversations and brainstorm about building which teaches them about the process of coordination. Moreover, when a rider requests assistance from teammates, he/she also establishes a teamwork bond. One of the attraction's draws, and what will bring people back, is the variety of ways and styles in which to build the car. Also, it is a just-right challenge for children to improve from their previous builds as well as from others' cars. Carstruction riders definitely play a more active role by means of sharing methodologies, assembling bricks, and constructing cars together.

Figure 3-5 This computer-generated scenario of Carstruction visualizes whole-family-fun with the activity.

3.4 Spacejump

"Fun is when you get to run around," one little girl pointed out. Exactly, either because of people's intrinsic desire for free movement or their attempts to escape from the mundane life, people derive great pleasure from playing outdoors. From my questionnaire, the majority response to the question of what and where people choose to play was outdoor activities and games. Going outdoors and having as much movement as possible seems to be an intrinsic desire of people, and I applied this impulse to my amusement ride design.

3.4.1 Design Concept

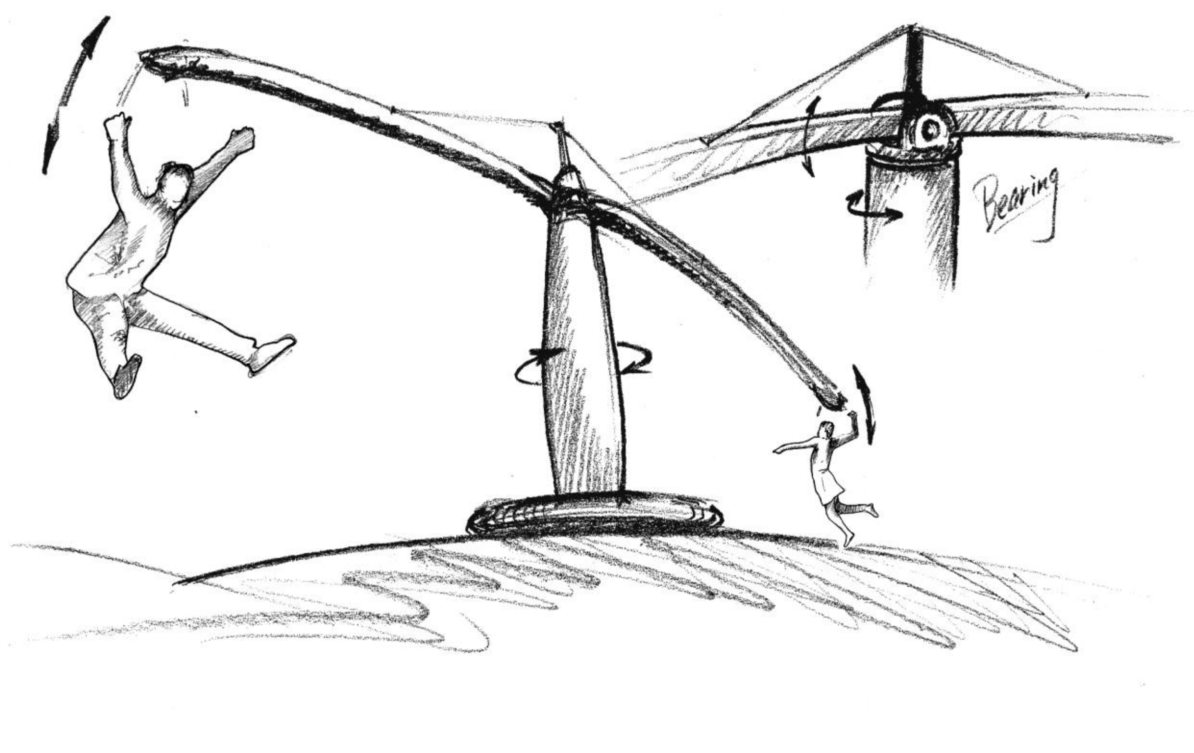

Figure 3-6 Fun is when you get to run around.

Spacejump provides an advanced and exaggerated movement for people. It simply applies the lever principle to its machinery to create an anti-gravitational environment for riders. Riders are able to go higher than usual when they do a running jump with assistance by the auxiliary. Meanwhile, while being above the ground, riders have a feeling of gliding while staying in the air. Figure 3-6 is sketches of Spacejump, including a detail view of the bearing, beam and king post. Figure 3-7 is more sketches of Spacejump concept.

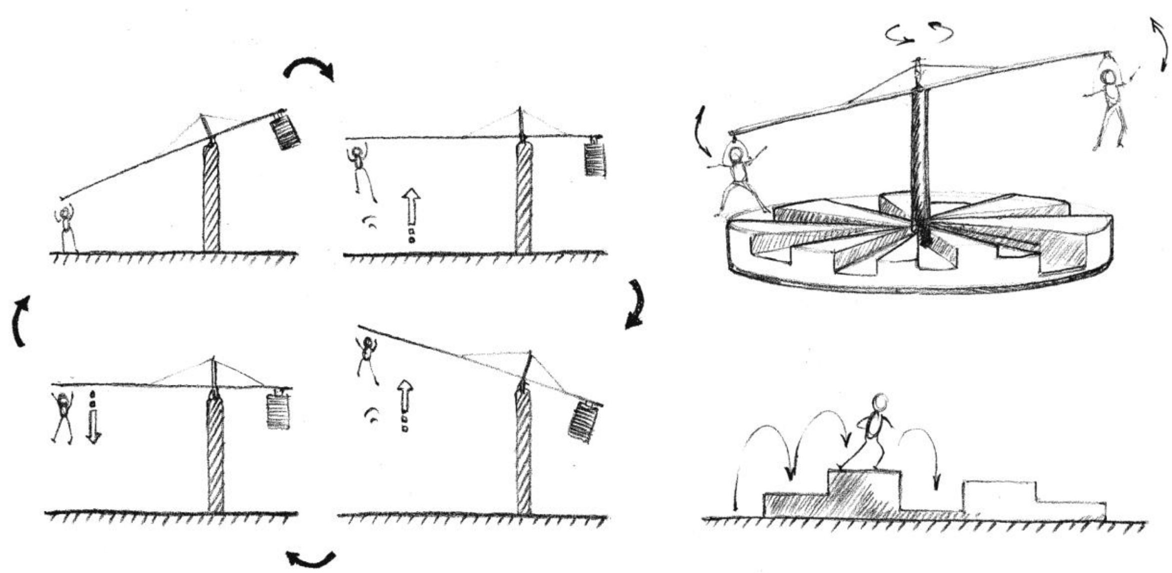

Figure 3-7 The concept development of Spacejump demonstrates each step of the process.

3.4.2 Configuration

Figure 3-8 is the computer-aided design model of Spacejump, which shows its overall shape and necessary structure. There is a post, beam and king post attachment for riders, with handles for better control. The bearing system can rotate and tilt.

Figure 3-8 Picture above is the computer-aided design and rendering of Spacejump.

There are three seat configurations of Spacejump (Figure 3-9). In the first, a person is attached at one end of a beam with a counterweight at the other. In the second, two people are attached to the beam, one at each end. The third one, two people are attached at one end and a counterweight at the other. Two people on the ride can have more emotional and physical interactions. For example, a father can try to stay longer on the ground to increase the time his son is in the air at the other end. When a mother holds her child at one end, they have more physical contact, which aids bonding.

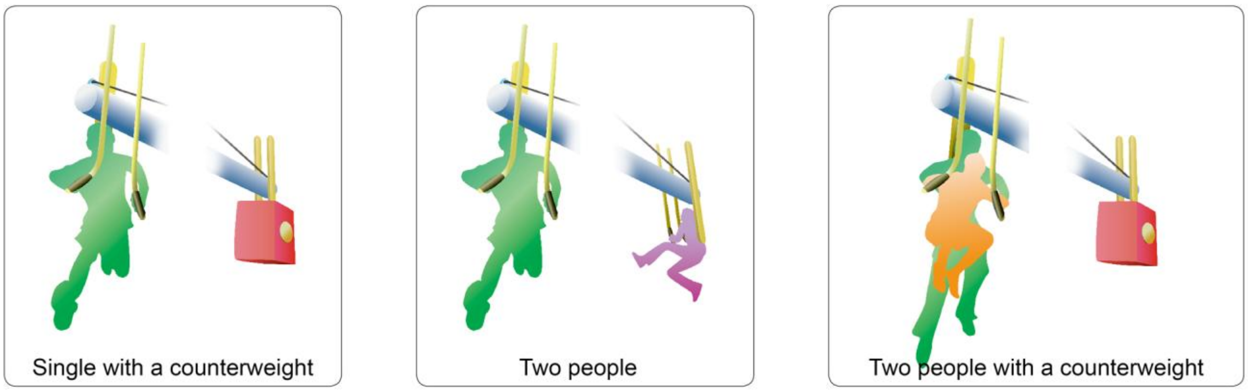

Figure 3-9 The seat configurations of Spacejump demonstrates all three positions.

An extra sliding counterweight system is applied to Spacejump whenever there is different weight at each end. According to the lever principle, the system is balanced only if the torque (the weight times the distance) on each end is equal. The person’s weight will be considered so that the distance from the person to the post can be determined, the weight of the counterweight can be fixed, and finally, the distance from the counterweight to the post can be calculated by the formula. The sliding counterweight is shifted to the position by a pneumatic system and fixed during the ride.

3.4.3 Operation

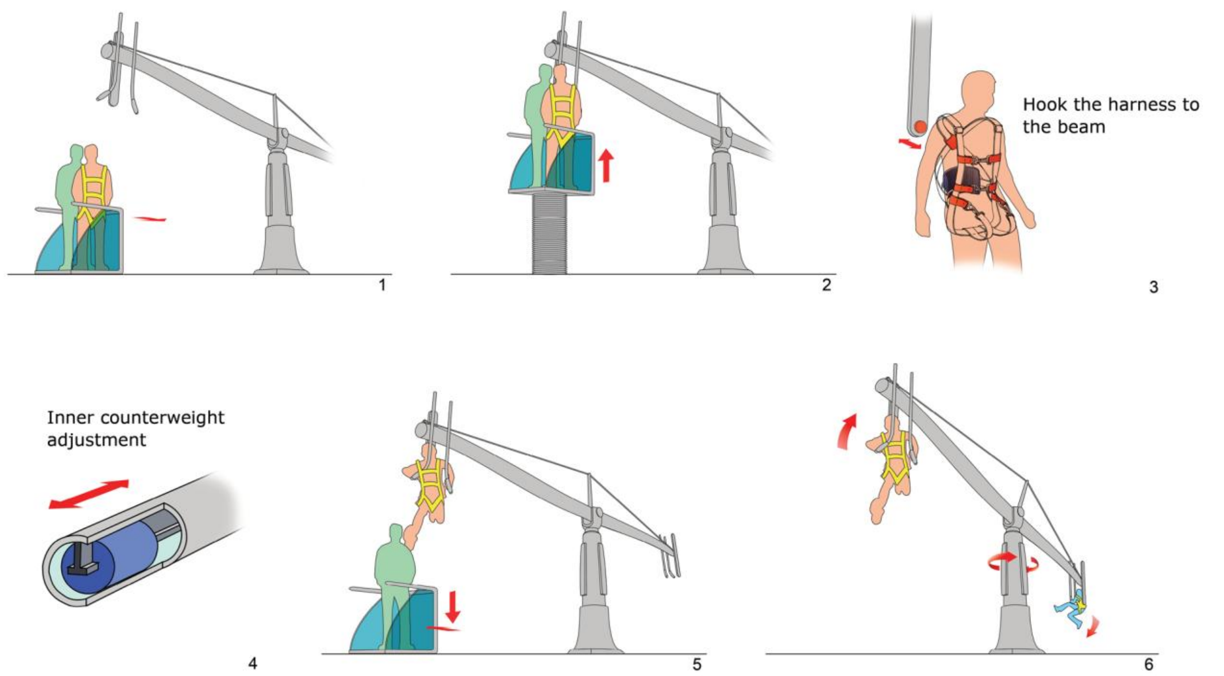

Figure 3-10 Above is a step-by-step rendering of the operation of Spacejump.

Figure 3-10 is the operation diagram of Spacejump. Since riders' weights are inputted in advance, they are used as the reference of the system balance. At one end of the beam, an operator goes with the rider to assure he is seated safely. The original design of the seat is a harness worn on the rider attached to the beam. A handle bar with thirty-degree outward shape provides an ergonomic component for grabbing. Ideally, it provides maximum freedom as far as movement for riders compared to a seat. Another operator does the same thing at the other end. Meanwhile, the sliding counterweight is tuned to balance the whole system.

A major concern while designing the ride was how many people can be served per hour. Two operators at both ends working simultaneously can save idling time. After operators have completed their adjustments, the fun begins. Spacejump is a time-based ride, which means riders have limited time – for instance, five minutes – on the ride. When time is up, operators detach riders from Spacejump.

3.4.4 Dimensions

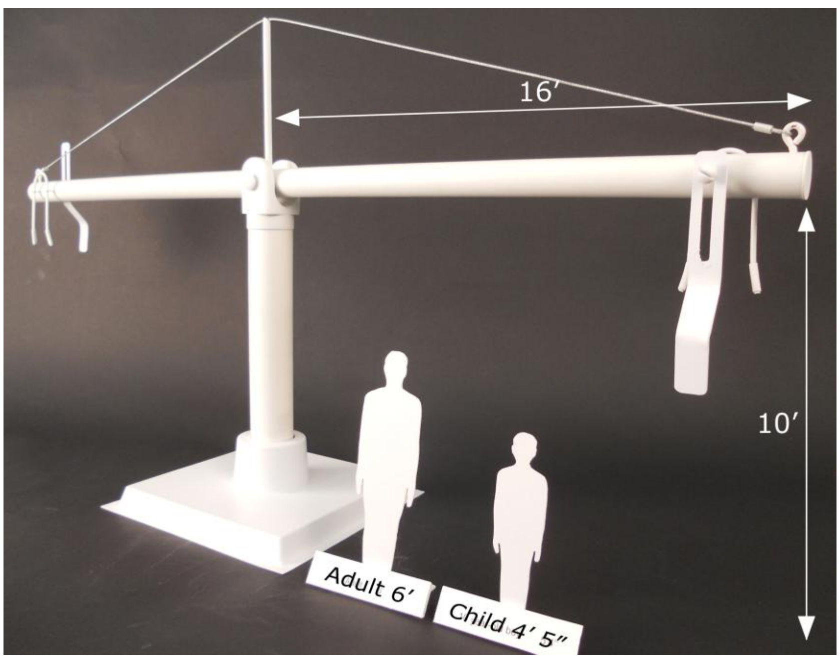

Figure 3-11 A 1:10 model represents the dimensions of Spacejump.

Figure 3-11 shows the dimensions of Spacejump. The beam spans thirty-two feet, and the post is ten feet high. The height of the rider above the ground is adjustable to meet each rider's preferences.

3.4.5 Scenario Simulation

Figure 3-12 This computer-generated depiction of Spacejump demonstrates how it may be used in an amusement park.

The rider has an anti-gravitational experience on Spacejump while doing a running jump. He or she can experience the thrill of limited flight in complete safety. As riders glide through the air, they experience childlike fun, and feel true happiness. Moreover, because riders drive the rotation and lifting, they play a more active role and are more deeply involved with the ride. Spacejump is a family ride. When parents and children are both seated at one end, the physical touch promotes healthy parent-child relationships.

Chapter 4 Mockup Fabrication

> *We cannot separate our knowledge of a domain from our interactions with that domain. Nor can we consider the knowledge that is integrated with the activity outside the context in which it was constructed*
>
> – David Jonassen [18]

In order to evaluate the feasibility of Spacejump in terms of technology, marketability and legality, I set up a two-stage plan to test the fun elements, and verify the concept of Spacejump. In the first stage, to assure that the lever principle can result in an anti-gravitational experience, a 16-foot long wood beam is built to serve as a simulation test. In the second stage, a semi-scale mockup is constructed to confirm the design and collect users' feedback after a trial run.

4.1 Beam

The beam is made from three 16-foot long two by fours affixed together side by side. They are attached with 12 bolts (including nuts and washers) spaced at one-foot intervals to strengthen the conjunction. Each end of the beam is clamped by a U-shape piece of steel. Instead of using a post or a tripod to lift the beam, I use a steel wire to hang the beam for simulating. Some details are shown in the Figure 4-1.

Figure 4-1 The trial beam is attached to the carabiner, the clamper, the wire, and the bolt.

4.1.1 Computer-Aided Design

Figure 4-2 shows the exploded view of the beam structure and its dimensions.

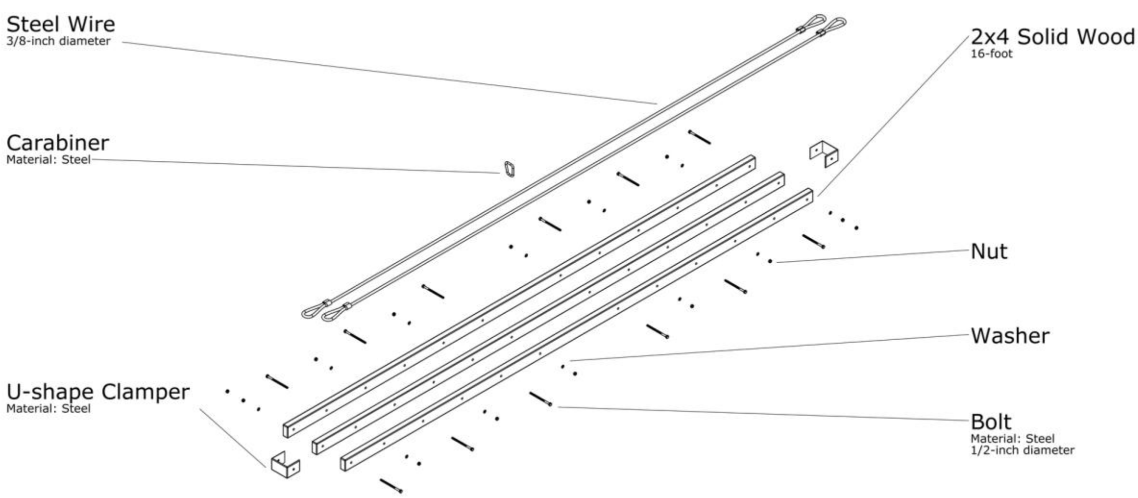

Figure 4-2 This exploded view specifies the dimensions of the beam.

4.1.2 Simulation

One of my thesis committee members, Prof. Kim Sherman, assisted me in testing and simulating the lever principle applied to the beam. We simply hung the beam underneath a simple rack comprised of a cylinder and a steel bar. We verified that people at each end with equal torque can tilt the beam up and down slowly, which provided a close approximation of an anti-gravitational experience. Also, the person at each end expended minimal effort to lift the person at the other end because of the lever principle. This was a successful test in terms of verifying the lever principle applied to the beam. Though the beam is only half the actual size, we are confident the full-size beam will work successfully.

Figure 4-3 A 16-foot long wood beam is built first for simulation and tests.

In addition to successfully testing the lever principle applied to the beam, the second stage of the verification was to lift the beam, and add a seat and a counterweight to simulate the whole system. I started building a semi-scale mockup of Spacejump, including a post and related structure.

4.2 Semi-Scale Mockup

In the second stage in May of 2010, I met with Rob Norris, the President of Seabreeze Amusement Park, to get his and his crew’s input on Spacejump. Dean Shorey, ride mechanic, very generously gave me suggestions, and we worked together over the summer to build a semi-scale mockup. In total, this process took twenty-five hours, excluding meetings, and consequently several unclear and amateur details of Spacejump were improved. Later, an open demonstration of my thesis presentation was held to gather users' feedback.

Figure 4-4 The semi-scale mockup of Spacejump includes a newly designed seat.

Dean Shorey and I modified some features of Spacejump in the process of fabrication. One of the significant changes was the seat. We tested while wearing the harness and being attached to a sling. I found when I was above the ground, I was constrained by the harness and couldn't move very much. To solve this we replaced the harness with a 14-inch longitudinal soft pad with an upright handle bar. We positioned the pad underneath the rider to provide enough sitting surface and maximize the mobility of legs. The handle bar was in front of the rider’s chest while the rider is seated. These design adjustments are essential for riders to do a smooth running jump.

4.2.1 Computer-Aided Design

Figure 4-2 shows the structure, and an exploded view of the Spacejump mockup. Four six-foot stretch-out trestles and a 10-foot-tall post create a quadropod structure to support an 18-foot-long beam. The rotatable bearing allows the beam to tilt up and down within certain degrees. A king post is applied to the beam to prevent it from sagging. A counterweight is tied at one end, and a seat is attached to the other. The swinging seat faces the tangent line, which is also its swing axle to the circuit motion.

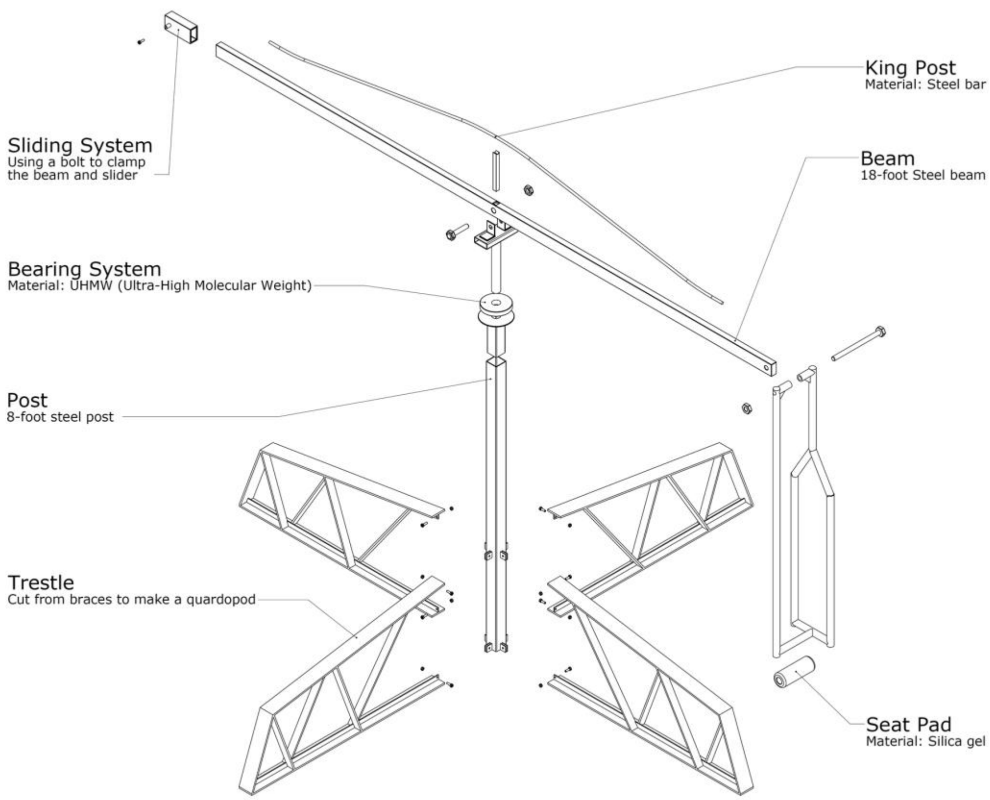

Figure 4-5 The structure is better seen in this exploded view of the Spacejump mockup.

4.2.2 Fabrication

We built the Spacejump mockup from June to August, 2010. In order to keep the fabrication process green, and to protect the environment, most materials were reused from retired construction materials at Seabreeze Amusement Park. The following pictures summarize the fabrication. To view the complete process, please see the attached DVD.

✧ Bearing System

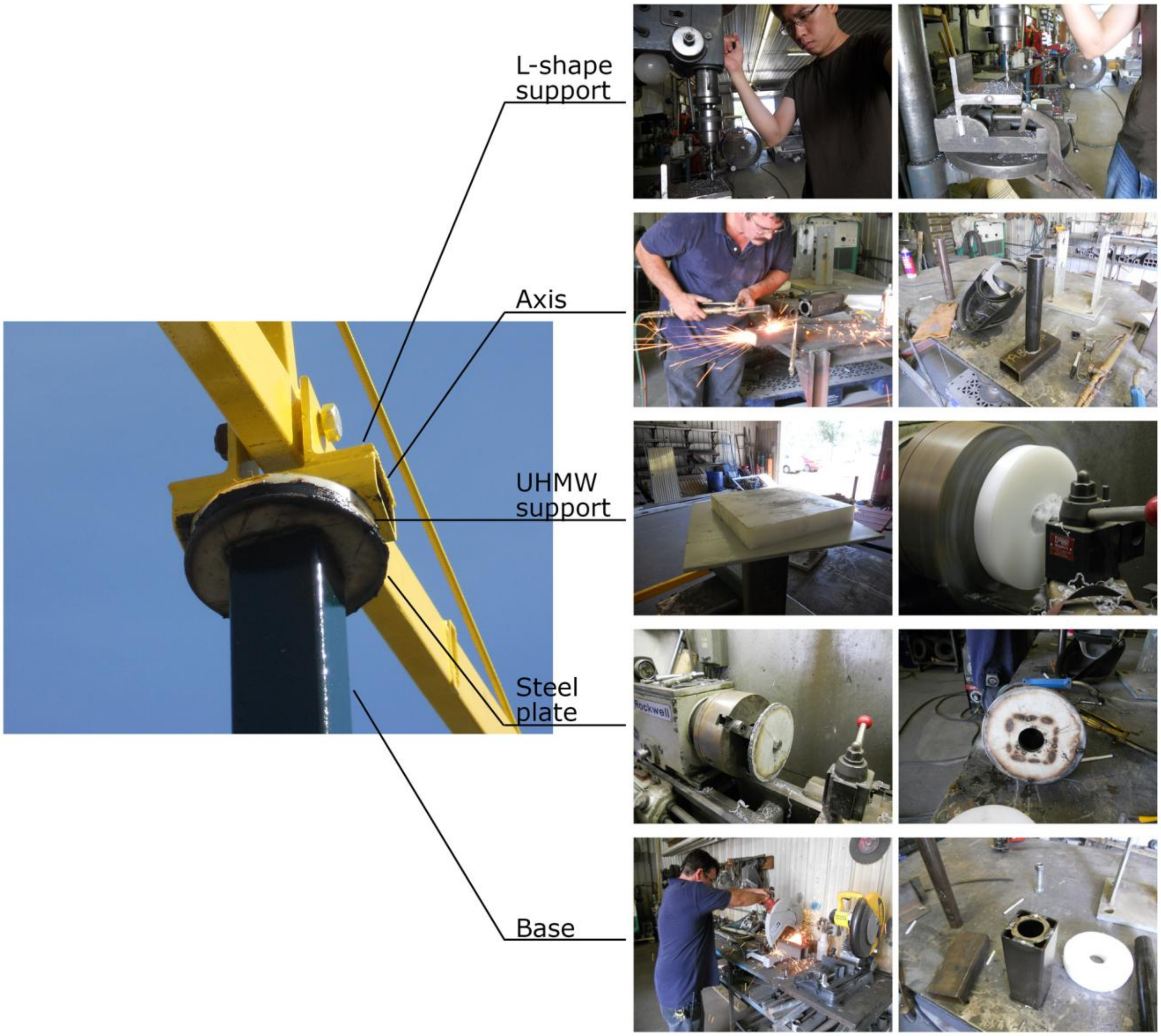

Figure 4-6 Above - The detail of the bearing system of Spacejump mockup.

✧ Beam

Figure 4-7 Above - The king post and the beam of the Spacejump mockup.

✧ Trestle

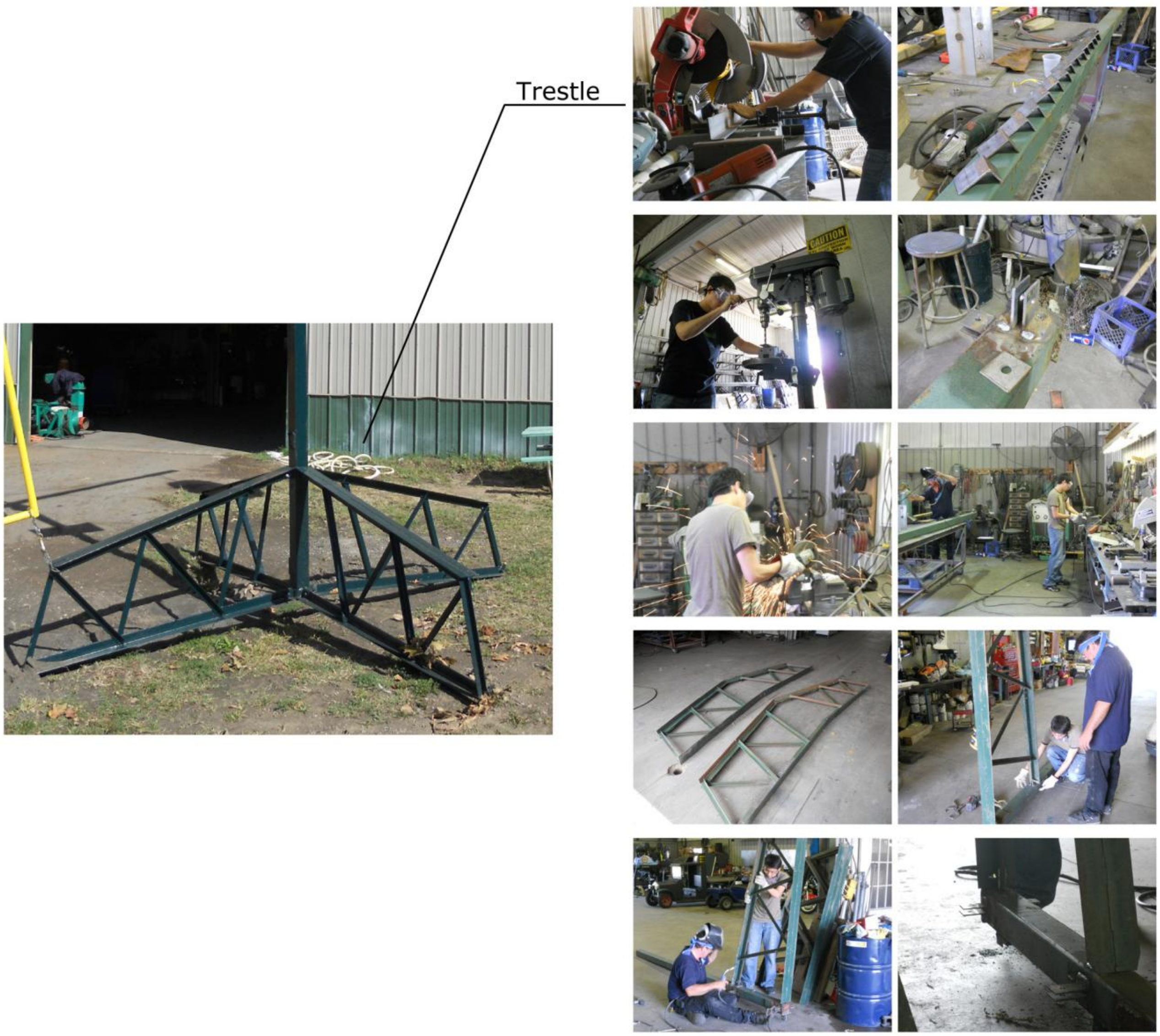

Figure 4-8 Above - The trestle of the Spacejump mockup.

✧ Slide System & Counterweight

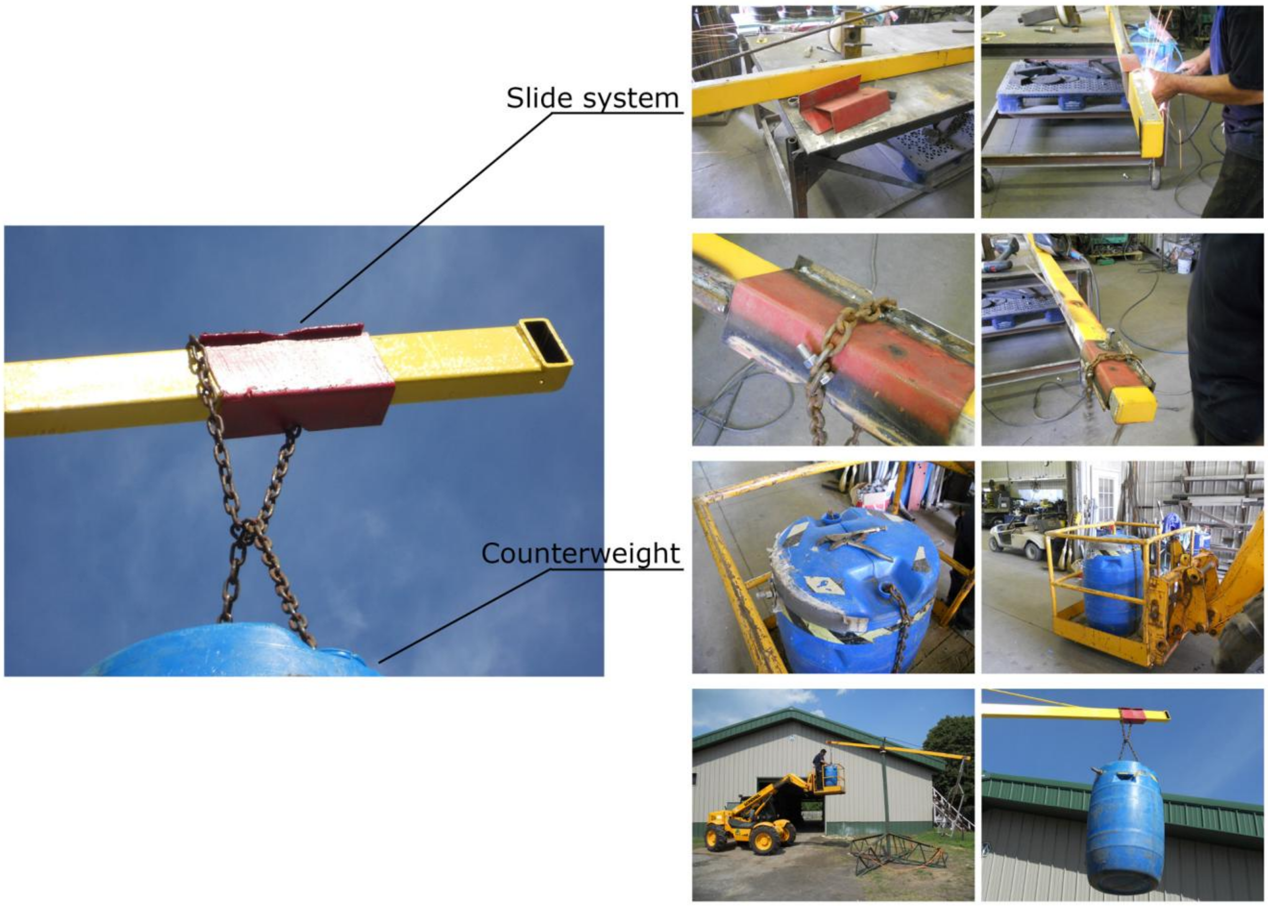

Figure 4-9 Above - The slide system and the counterweight of the Spacejump mockup.

✧ Seat

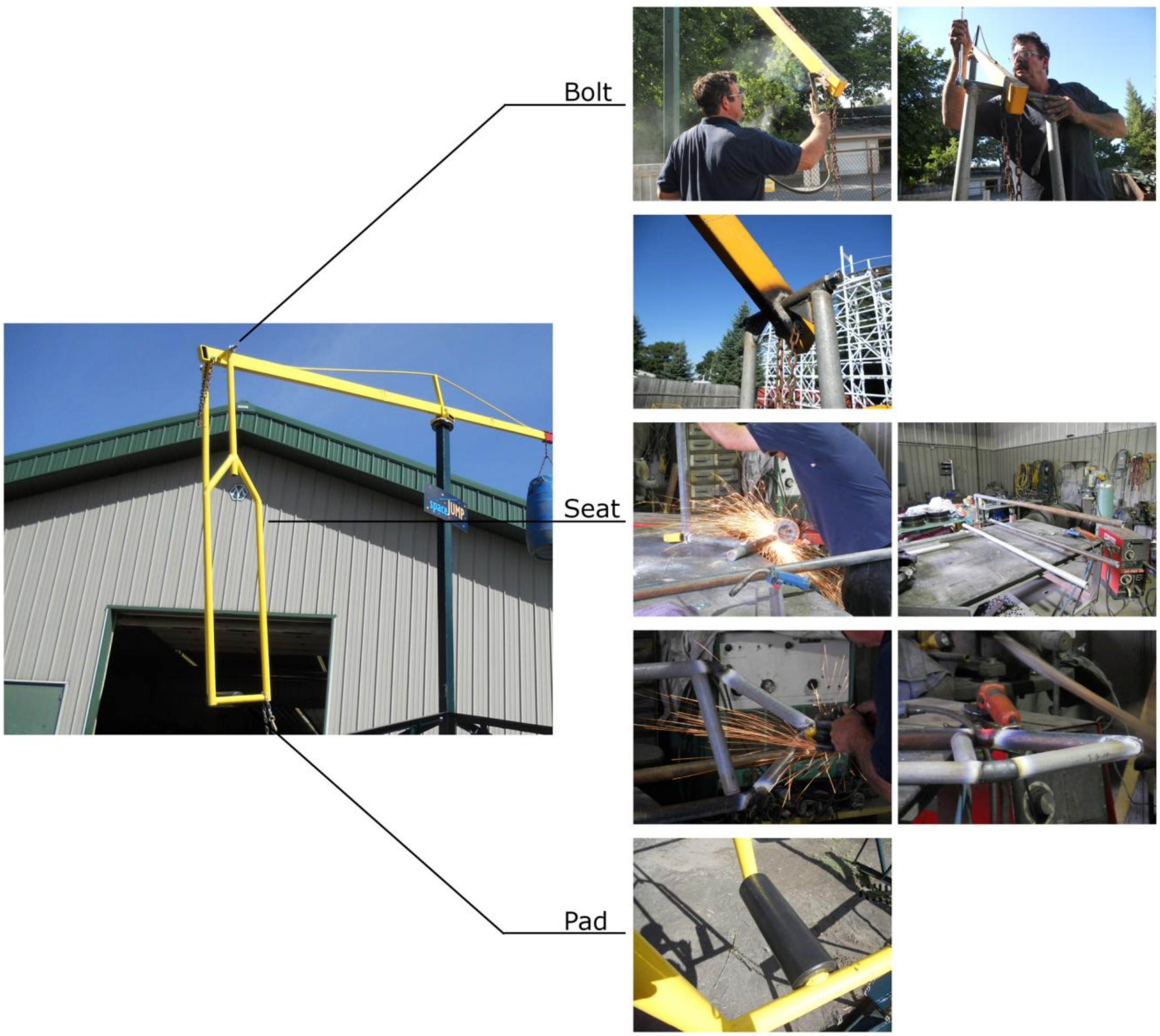

Figure 4-10 Above - The seat for the Spacejump mockup.

✧ Assembly

Figure 4-11 Above - The final assembly of the Spacejump mockup.

Chapter 5 Conclusion

Play is the answer to the question, how does anything new ever come about?

– Jean Piaget

The goal of my thesis is not to dispute or discourage creating and building faster and higher roller coasters. Rather, I hope Carstruction and Spacejump will pioneer a different direction for amusement ride design. In this chapter, based on the information and the feedback from users, I discuss further my amusement ride design as well as ideas for the future.

5.1 Presentation and Demonstration

Helped by Mr. Rob Norris and Mr. Dean Shorey, President and Ride Mechanic respectively at Seabreeze Amusement Park, Seabreeze hosted my thesis presentation and Spacejump mockup demonstration on September 20th 2010. This was an ideal way to gather firsthand feedback about the premise of my thesis. People were invited to take a ride on Spacejump to experience for themselves the fun it provides. Please watch the video and view photos on the attached DVD to view the full demonstration.

5.2 Users' Feedback

Users' feedback was collected immediately after the demonstration to use as inspiration for future refinements to the ride. I sent out a questionnaire to riders, Ho-Chan Kan, Chia-Chen Lee, and Yu-Qiong Wang, to collect opinions, which are listed below.

Figure 5-1 People participated in the thesis presentation and demonstration of the Spacejump mockup.

Figure 5-2 People were invited to take a ride on Spacejump.

1: How did you feel emotionally while you were on the ride? (Free, relaxed, nervous, complex, or others…) Why?

Kan: It was an exciting experience with Spacejump. I felt a little bit nervous. I experienced a scaring feeling similarly some other rides I took before.

Lee: I feel so weightless but quite nervous because I worried that I will be hung in the air and could never get down.

Wang: Curious #_# (And worried about my shoes I think!)

Figure 5-3 Users' feedback was the inspiration for the next version of Spacejump.

2. How did you feel about the seat? (Feeling safe and comfortable? Do you have enough free movement to run and jump? and others...) Why?

Kan: To be honest, I was uncomfortable with the seat because it was not easy to put my butt right in the center of the seat.

Lee: I like the seat which has bars in the front and in the back, which is safer. However, bars might also block the freedom of the legs. Maybe there is another way such as using soft material for the seat and strong material for securing people's chest and back.

Wang: Seat is great, simple but secure! I liked the idea that I could hold bars while sitting on Spacejump. I also felt free to do whatever I wanted!

Figure 5-4 Riders Ho-Chan Kan, Chia-Chen Lee, and Yu-Qiong Wang gave some feedback of Spacejump.

3. What do you think the most distinctive part and the most unfavorable part of Spacejump according to your riding experience?

Kan: I think Spacejump is an interesting ride because it is not just a passive ride but a ride driven by your movement. Riders are more active while taking Spacejump. The most unfavorable part of Spacejump is the seat.

Lee: Though I stayed in the air long because I am light-weighted, but with reasonable height above the ground, I didn’t feel dangerous. However, I think height is an issue and I wonder that people who have acrophobia would ride it or not. Also, maybe because of visual deviation, I felt unbalanced when I was the only one on Spacejump. I would be more intoxicated and even crazy to go high if there is cushion underneath the Spacejump.

Wang: I think the seat is great! There is just one comment that when I was having problem figuring out how to “jump”, I kind of wished there was a pad beneath the seat so I don’t fall as low as to the ground.

4. Do you have any specific comment on Spacejump?

Kan: I was afraid that I (the seat) would hit the ground when I bounced up and down a lot. This is generally related to safety issue.

Lee: I felt fun and had anti-gravitational experience. I expect more fun when more people at the same time join together on the ride. I am also thinking some crazy ideas like adding water pistols on the ride…. A recommendation is that to put cushion underneath the ride to prevent the impact of landing. I am curious that how you know how much difference it should be between a person and a counterweight.

Wang: Will there be a training session available for people like me who don't know how to "jump"?

Even it is the first time to ride Spacejump, all riders become adept soon and are entertained by their trial run on Spacejump. Basically the major concerns from riders are safety issues such as adding a soft pad underneath Spacejump and the seat. The most distinctive part is the fun which comes from the anti-gravitational experience and free movement of Spacejump.

5.3 Continuation

Only adults took rides on the Spacejump demonstration though it is designed for parents and children. I plan to invite families to take rides in the future and gather parents' and children's opinions to increase feedback data. In addition, three different seat configurations will be tested as well.

Carstruction and Spacejump have potential for use by amusement parks and edutainment centers in terms of their entertainment, interactivity and support for active participation. Therefore, I collected important information from the design procedure, fabrication process, and uses' feedback to sum up the modification of future rides.

5.3.1 Carstruction

The next step of Carstruction is to build a mockup to verify the feasibility of the design. The bricks are key elements of Carstruction, and the material and sustainability are key elements of the bricks. My future works include:

- Find a proper material for bricks taking into consideration to sustainability and weight.
- Define more details of the system operation such as testifying and tuning the time period of riders building a car in Carstruction.
- Demonstrate the mockup and collect users' for the next version of Carstruction.

5.3.2 Spacejump v2.1

During my thesis presentation, in the Q&A section, Prof. Alan Reddig provided an inspiration for modifying Spacejump. After more discussion with him, we agreed it would be a good idea for Spacejump v2.1. Figure 5-5 shows the modification of Spacejump v2.1.

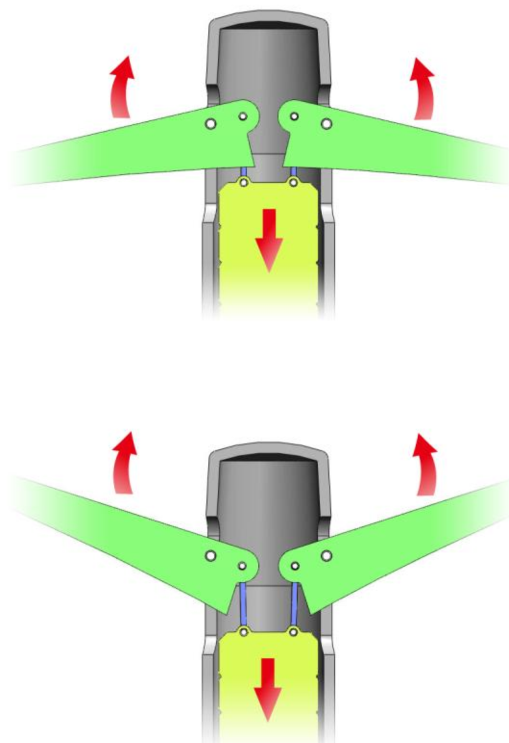

Figure 5-5 The mechanism of Spacejump v2.1 features the counterweight at the center of the system.

A counterweight is not attached at one end of the beam, but is in the center of Spacejump v2.1. Instead of using a single beam and bearing, there are two beams and bearings. Two beams stretch out from the central post, and are connected to the same counterweight located in the center of

Spacejump v2.1. Two people are seated at each end of the beam. They still do the running jump to have an anti-gravitational experience, but unlike the original Spacejump, Spacejump v2.1 allows riders to jump up and down, run on the ground, and glide in the air simultaneously.

There are several advantages from this improved design, listed as follows:

- Riders collaborate together to make a smooth running jump. Now there is a just-right challenge for them to work cohesively and have a better rapport between each other while jumping.
- Spacejump v2.1 has wider appeal for family members. Riders now work together to lift the same counterweight, so a bigger and stronger person can take on more of the effort. For instance, a father can lift more weight compared to his son while jumping, pushing both beams to go up.
- A counterweight located in the center of Spacejump v2.1 helps to stabilize the system. The present counterweight has only vertical movement, and doesn't swing or turn around while riders are running and jumping.

5.3.3 Spacejump v2.2

How many people an amusement ride can serve at one time is one of the big concerns of marketability at amusement parks. Because of this concern, Spacejump v2.2 increases the number of beams to provide more seats. The beams are separated into groups, and connected to different counterweights. The advantages of Spacejump v2.2 are listed below.

- More people can now be served at same time on Spacejump v2.2, which is an obvious advantage. Now plenty of families can ride and have fun at the same time.

- ✧ The rotation of Spacejump v2.2 is driven by more people, which saves each rider's efforts.
- ✧ Riders still have physical touch on the ride. Figure 5-6 shows that two people sit together at the end of each beam, holding hands while jumping.

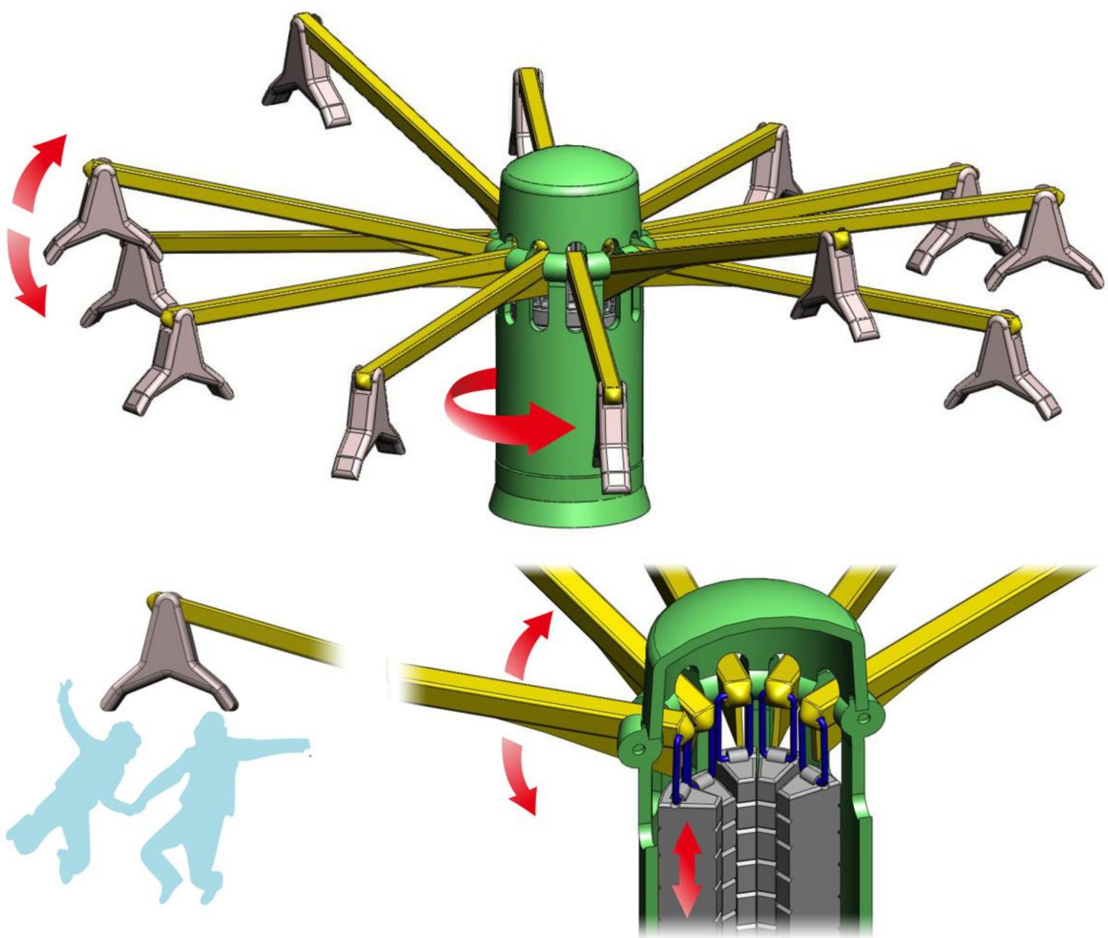

Figure 5-6 The mechanism of Spacejump v2.2 allows each beam to be attached a counterweight and operate independently. Two people are attached at the end of the beam.

I learned why, how, and what a designer can design from my thesis project. First, I conducted research to understand the essence of the design process. The heart, not the appearance, is the key to the problem and solution. For example, the beauty of a bumper car doesn't mean anything. The true sparkle is the mixture of a maneuverable steering wheel and unpredictable bump. Second, the design must consider "Human" factors. Design is not an unrestrained thinking process, producing hasty ideas to create an unreasoned design work. On the contrary, design is a careful analysis conducted to achieve a reasonable goal by continuously modifying concepts to be as near perfect as possible. Third, it is a practical and efficient way to discover what is irrational through implementation, and then to improve the design. For instance, I discarded the harness idea of Spacejump during the fabrication process and designed a new seat.

Figure 5-7 I hope more rides will be installed in DazzleLand Amusement Park in the future.

I will continue exploring people's desire for play and fun, integrating these elements into new rides through a series of conscientious design processes. I hope more of these deliberately designed rides will be installed at Dazzleland in the future. For me, the biggest gratification and encouragement will always come from the happiness and enjoyment people of all ages experience on a ride I 'dreamed' expressly for them.

Bibliography

[1] Miller, F. P., Vandome, A. F. (2009) *Amusement park* J. McBrewster, (Ed.) Beau Bassin Mauritius: Alphascript publishing.

[2] Dattner, R. (1969). *Design for play.* New York, NY: Van Nostrand Reinhold Company.

[3] http://www.rcdb.com/

[4] Schifferstein, H. N. J., & Zwartkruis-Pelgrim, E. P. H. (2008). Consumer-product attachment: Measurement and design implications. *International Journal of Design, 2*(3), 1–13.

[5] Miller, E., & Kuhaneck, H. (2008). Children's perceptions of play experiences and the development of play preferences: A qualitative study. *American Journal of Occupational Therapy, 62,* 407–415.

[6] http://www.legoland.dk/en/

[7] http://www.legoland.dk/en/Explore/Activities/Pirate-Land/Pirate-Splash-Battle/

[8] http://www.legoland.dk/en/Explore/Activities/LEGO-City-/Falck-Fire-Brigade/

[9] http://www.cedarpoint.com/public/park/rides/coasters/top_thrill_dragster/

[10] Debord, K. (1996). *Childhood Years, ages six through twelve*. NC: North Carolina Cooperative Extension Service.

[11] Harackiewicz, J. (2004). The Effects of Cooperation and Competition on Intrinsic Motivation and Performance. *Journal of Personality and Social Psychology, 86,* 849–861.

[12] Lindsey, E. W., Mize, J., & Pettit, G. S. (1997). Differential Play Patterns of Mothers and

Fathers of Sons and Daughters: Implications for Children's Gender Role Development. *Sex Roles, 15*, 643-661.

[13] Charlesworth, W. R., & Dzur, C. (1987). Gender comparisons of preschoolers' behavior and resource utilization in group problem solving. *Child Development*, *58*, 191–200.

[14] De Jean, J., Upitis, R., Koch, C., & Young, J. (1999). The Story of Phoenix Quest: How girls respond to a prototype language and mathematics computer game. *Gender and Education*, *11*(2), 207–223.

[15] Sargent, L. W. (2003). *The power of parent-child play.* Carol Stream, IL: Tyndale House Publishers.

[16] Jernberg, A. M., & Booth, P. B. (2003). *Theraplay: Helping parents and children build better relationships through attachment-based play.* San Francisco, CA: Jossey-Bass Inc.

[17] Chapman, J. (2005). *Emotionally durable design: Objects, experiences and empathy.* Sterling, VA: Earthscan.

[18] Jonassen, D. (2000). *Learning: as activity.* Paper presented at The Meaning of Learning Project. Denver, CO. October 2000.