A Prototype For Narrative-based Interactivity In Theme Parks

Kirsten Kischuk
University of Central Florida

A PROTOTYPE FOR NARRATIVE-BASED INTERACTIVITY IN THEME PARKS

by

KIRSTEN KISCHUK
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ABSTRACT

The purpose of this thesis is to look at the potential for interactive devices to enhance the story of future theme park attractions. The most common interactive theme park rides are about game-based interaction, competition, and scoring, rather than about story, character, and plot. Research into cognitive science, interactivity, narrative, immersion, user interface, theming and other fields of study illuminated some potentially useful guidelines for creating compelling experiences for park guests. In order to test some of these ideas, an interactive device was constructed and tested with study subjects. Each study subject watched a video recording of an existing theme park ride while using the device, and then filled out a survey concerning their experience. The results revealed how subjects view character-driven interactive devices, how a device should be blended into a ride sequence, how subjects think interactivity and responsiveness should be structured in regards to themselves and the ride, and begins to hint at their motivations for using interactive devices.

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INTRODUCTION

The main question that I am trying to answer in this thesis is this: how can interactive devices can be used to enhance narrative immersion in theme parks? Specifically, can an interactive physical device that is used by a guest during a controlled time period help with narrative immersion within a fantasy-based world? This topic will involve looking carefully at theme park design, interactive theories, and narrative theory in order to produce some guidelines in this area.

Gaming is a genre that already focuses on interactivity. It has solved the problem of how to keep an audience engaged during an interaction, while rewarding them for good performance. Theme park designers, in their effort to bring the allure of interactivity into theme parks, brought the point-and-shoot interactivity of games into theme parks worldwide. Undoubtedly, there are ways to make attractions and public walkways more interactive, respecting the fact that theme parks are a unique medium, more related to theater, film, historic places, and thrill-seeking activities than to games. New modes of interactivity that suit the fleshed-out narratives of theme park rides have yet to be invented but are likely to be just on the horizon.

Theme parks are no small business venture. According to the Themed Entertainment Association (TEA), there were 122.8 million visits in 2007 to the top 20 North American parks, and 60.9 million visits to the top 20 European parks (TEA, 2007). All these millions of guests create huge revenues for their parent companies: Walt Disney Attractions, Merlin Entertainment Group, Universal Studios Recreation Group, Six Flags Inc, Busch Entertainment Corporation, Cedar Fair Entertainment Company, and many others. The most visited theme park in the world, Magic Kingdom at Walt Disney World in Orlando, Florida, racked up over 17 million visits alone last year (TEA, 2007). The literature prepared for Disney's investors shows that, of the $35 billion in revenues that the Walt Disney Company made last year, over $10 billion were from their parks and resorts. This is a large share of the pie, considering Disney's film division only made around $7.5 billion (The Walt Disney Company, 2007).

While theme parks bring in a lot of money, they also represent huge investments. The new Hard Rock Amusement Park in Myrtle Beach, South Carolina cost $400 million to build (Associated Press, 2007), while the upcoming renovation to Disney's California Adventure near Disneyland is estimated to cost $1.1 billion (just a bit more than it originally cost to build it in 2001) (Lindner, 2007). With the unprecedented extravagance of the new parks being built in Dubai, new additions to existing parks in Orlando, and potential development deals in Asia, that number will surely be pushed higher as competition and quality of product increases.

In a nutshell, building and maintaining a park for the paying public is not a small venture, and cannot be taken lightly. Theme parks enjoy an international audience, and while not all parks operate year-round, their product must be reliable and nearly pristine during the months that they are open. This may be one of the reasons, beyond cost, that parks are so tentative in their experiments with developing technologies. Nearly every part of their product is exposed to the view and critique of the customer. Any lapse in perceived quality and variety of offerings is likely to affect the park attendance. Therefore, the product must be well-maintained, represent high-quality customer service, and serve as a modern-day evolution of the concept of "spectacle" (Brown, 2002). The term "spectacle" came from old theatrical traditions of creating something curious, dramatic, amazing, or shocking that would draw crowds of people just to see it. In turn-of-the-century theme parks, seeing a building on fire, watching an elephant be electrocuted, or viewing babies in incubators provided reasons for people to come, just to say that they saw something amazing, shocking, and rare (Weinstein, 1992). Modern theme parks rely on spectacle in a similar way, except that the spectacle is often in the complexity of the "cutting-edge" technology that makes the illusion more real, the height of a roller coaster, or the volume of pyrotechnics used in the nighttime show. Theme parks are about the amazing things that the guest saw and experienced, which makes them want to return again. Technology, in its various kinds, has historically been a part of what creates spectacle and draws guests in. It likely always will be.

The industry as it stands has no known written conventions, guidelines, or psychological theories for implementing these technologies. Only in the past 20 years have books such as *Designing Disney's Theme Parks: The Architecture of Reassurance* (Marling, 1998) and *Designing Disney: Imagineering and the Art of Show* (Hench, 2003) begun to describe the ideas behind the physical design of parks and the emotional effect of color, theme, and architecture. With all of the new publications about theme park design and creation, now is a great time to begin to discuss how interactive technologies affect and are affected by tangible physical environments and narrative.

There is usually some debate and misunderstanding about the difference between an amusement park and a theme park. Christina Harris (2002) put it rather concisely when she stated that:

> "The term 'amusement park' means 'a place to be amused' whereas a 'theme park' means 'a place for stories'. Generally, an amusement park has little or no theme and is simply a collection of rides while a theme park is like a three-dimensional story and its guests are active participants in the narrative." (p. 64)

Amusement parks are often nicknamed “steel parks” simply because they often specialize in coasters and other high-thrill rides. Their skyline is one of steel and scaffolding. A theme park is more concerned with story, and the steel scaffolding is often hidden beneath or behind themed buildings or facades. While there are certainly some parks that blur the line between the two, it is generally agreed that parks such as Universal Studios and Magic Kingdom are theme parks, while competitors such as Six Flags and King’s Island are amusement parks. An amusement park sometimes has themes or characters, but the themes and storylines are usually very rudimentary and poorly developed. Theme parks present the guest with a narrative that they can participate in, and thus it makes sense to consider how interactivity might contribute to the guest’s experience of story.

Central to this thesis is not just defining the problem of how interactive devices could work in theme park rides to enhance story effectively, but creating a prototype interactive device that demonstrates some of the central ideas and guidelines that have been discovered. That device was tested with live participants in a very simple laboratory setting to examine the idea that an interactive device can enhance narrative and the guest’s sense of immersion. The complete set of ideas presented in this thesis are too complex to test in one experiment, but are solidly based on the research of other fields and will hopefully begin to spark fresh conversation about what will work in the field.

CHAPTER ONE: LITERATURE REVIEW

The guiding question of this thesis is: how can interactive devices can be used to enhance narrative immersion in theme parks? Interactive devices are used in theme parks to transmit information and allow guests to play games, but are rarely used as a means of deepening the guest's connection with story. Therefore the salient question is: can an interactive physical device used by a guest during a controlled time period deepen narrative immersion into a fantasy-based world?

The prototype device that I built was intended to take the best information about how humans become immersed in tasks, interfaces, and stories and use it to create the best possible model of interaction for theme parks given the current information and state of the industry. The result was a simple device that attempted to illustrate some core ideas about interactivity. Future devices will certainly be more sophisticated, but even a simple device can tell us much about how humans approach and relate to computer-based devices in a theme park dark ride. To simulate a dark ride, I used a large wall-mounted television to show ride video in a darkened room. Guests interacted with the device in a way analogous to what interaction in a theme park ride would be. Obviously, this does not completely simulate the experience of being on a theme park ride. The main idea, however, was simply to test how a device is perceived in confluence with an established narrative in order to guide future exploration.

My approach to this thesis was to use grounded research to generate theories from the data gathered from participant experiences with the prototype device (Martin & Turner, 1986). I used surveys to gather thoughts and feedback from 14 participants to discover their thoughts about interaction with story and the degree of narrative immersion that they experienced. In researching the topic, I read relevant literature in order to gather preliminary information to guide the scope and conceptual guidelines for the device itself and form ideas about how a device can connect with an audience. In keeping with the grounded research method, I have listed these “biases” at the outset in the next chapter, and then discussed how the data either confirms or opposes these initial biases and as well as what theories emerge from the data itself (Rennie, Phillips & Quartaro, 1988). These biases will be called “Preliminary Guiding Principles” because these concepts, which have emerged from the articles that have been reviewed, have guided the design of the device itself as well as the concepts explored in the surveys.

The research articles were collected over the course of two years in the process of attempting to explore the subject from every useful angle. Article topics include: theme parks, narrative, interactivity, attention, immersion, flow, interface, ubiquitous technology, and entertainment technology. From those articles, the ones that emerged as seeming most relevant to interactivity in theme parks dealt mainly with narrative, interactivity, interface, immersion, and emotion. The literature review below shows how the knowledge and theories in modern research strongly imply some ways that interactive devices might be integrated into theme park rides. Additionally, the opinions of industry professionals and the current state of the industry have been included. In the chapter following this one, the research will be summarized into more succinct guidelines (biases) that have served as a rule of thumb during the device design phase. First though, I will review the literature for narrative, interactivity, interface, immersion, and emotion as it relates to theme parks.

Narrative

“People will only remember the great times they had at a theme park if you offer storytelling attractions; they touch people’s emotions.”

Bart Dohmen of BRC Imagination Arts, quoted by Korenteng (2005, pg. 1)

“Since we can’t control the guest’s point of view or force a purely linear sequence of events, as in a film, we create concentric layers of space with a sequence of ideas and impacts. This is at the heart of narrative place-making. The place itself, in every detail, must reiterate the core ideas that drive the story. The guest freely passes through the layers at all kinds of tangents but always passes through some sequence of narrative logic and emotion.”

Joe Rohde, Senior Vice President and Creative Executive at Disney Imagineering, in “From Myth to Mountain” (2006, pg. 3)

For theme parks, narrative creates the scaffolding upon which every other decision is made. Each part of an attraction, from the thrilling drops to the props and paint treatment, is intended to draw the guests’ imagination and emotion into the story (Hench, 2003). Theme parks use the term “story” and “narrative” interchangeably and loosely. Some of the most famous attractions Disney has ever created use theme, space, and time as elements to communicate emotion, but do not sequence events in any narrative manner (Marling, 1998). The most notable in this group of attractions are the *Haunted Mansion* and *Pirates of the Caribbean*. The attractions present a sequence of thematically related scenes with no central characters or clear narrative order. Translating the meaning of the scenes and characters is left to the guest's imagination. The success of this approach is evidenced by the reams of fan fiction and written conversation that has flooded the Internet speculating the "true" story of each attraction. Only recently have these attractions been translated into major Hollywood films, connecting their disconnected scenes into a larger overarching narratives. Their evocativeness from the very beginning may well stem from the fact that the rides were originally based on strong story ideas, which were used to create atmosphere, rules, structure, and meanings to direct the creation of the attraction (Jenkins, 2005; Rafferty & Gordan, 1996). In most cases, the story (the place, the time, and characters) comes first and colors every part of the design process that comes after. The story and genre choices made by the designers create emotional cues which make it easier for guests to connect with the experience. The audience automatically understands what a haunted house is or what pirates do, they know Peter Pan and the flight to Neverland, and have admired Spiderman since childhood. This understanding enables the designers to wrap that world around the guest and hold their imagination captive without having to maintain a linear and unbroken storyline. It is the guest's narrative imagination and connection with folk and popular culture stories that makes theme parks such a successful experience. As we understand the mechanics of story, it will be easier to use its strengths to draw the guest's emotion and imagination into the interactive components of a ride.

LaMarcus Adna Thompson may have been the first to use narrative as a driving force for an amusement attraction. In the 1900s, he transformed his partially enclosed roller coasters by adding car-triggered lamps that lit tableaux, panoramas, and biblical scenes (Brown, 2002). This was the birth of what we now call a "dark ride": that is, a ride that is enclosed within a building or structure, so that the lighting, soundscape, environment, set pieces, and climate can all be carefully controlled to serve the needs of a particular story. Since then, “story” has become sort of a touchstone for designers. When a park is being designed, experienced writers are hired to write narratives in order to sell the idea to investors and decision-makers and create an overall direction for design efforts. Theme park narratives are unique among media. John Hench (2003, p. 67), one of Disneyland’s original designers, puts theme park design in context of other media by saying: “Our approach to designing themed environments in which every element contributes to tell stories derives mainly from cinema and theater, with this crucial difference: theme-park design is a three-dimensional storytelling art that places guests in the story environment.” With the guest surrounded by story, they cannot be left completely unacknowledged. They have stepped into the movie screen, so to speak, and if they are really supposed to be in that world, they cannot be treated as invisible spectators. In many attractions (e.g. *Jaws*, *Earthquake*, *Men in Black*, *Stitch’s Great Escape*, *Star Tours*, and *Mission: Space*), the guest is put squarely in the middle of the action and conflict. They are the secret service trainee, movie star, or traveler. With billions of dollars riding on whether or not a guest finds these experiences compelling, it is important to begin to identify exactly what aspects of story are functioning to make guests feel fulfilled and desire to visit again and again.

Story can be defined objectively as a way that we organize information and share it with others (Fiore & McDaniel, 2006), analytically as a series of levels of meaning and connotation (Barthes, 1977), poetically as a purposeful construction designed to evoke emotion (Jose & Brewer, 1984), or pragmatically as a series of events that are connected and presented by a narrator (Worth, 2004). All of these could be technically correct, which brings to bear the fact that the concept of “story” is much more complex than one might think at first glance. A true definition would be so intricate (and contested) that it would merit an entire paper onto itself. A theme park narrative could correspond to any or all of these definitions.

One of the key factors operating in theme park narratives could be what Bruner (1991) calls “breach”. Bruner tells us that powerful stories are often about an expected script that is deviated against. Theme parks are often about traveling to improbable places, the juxtaposition of strange circumstances, something going terribly wrong, and the “unexpected” event turning the tables on the guest. The guest comes into a story world that is relatively peaceful, stable, and expected when a catalyst event triggers a seeming out-of-control rush of events that leads to a thrilling conclusion. This sequence could describe something as basic as a rollercoaster, something as elegant as a storybook dark ride, or something as intense as the most modern thrill-based dark ride. When something happens that breaks the normal flow of events, we are immediately interested, drawn in, and engaged.

In a theme park, the designer wants the guest to feel surrounded and immersed in the story world. For example, at Islands of Adventure in Orlando, Florida, the world of the famous Harry Potter novels is about to become realized in cement and steel. Guests will be able to visit famous locations, such as Hogwarts, Hogsmead pub, and the Forbidden Forest. It is hoped that guests will feel like they are immersed and emotionally involved in this exciting story world. For a theme park, emotional attachment can easily correlate to dollars spent on themed food and merchandise, so that the guest can take a piece of the experience with them. The commitment to use the Harry Potter stories as a basis for a whole land correlates with research about narrative in general. For example, Green (2004) has found that prior knowledge and experience with story content aids “transportation” – that is, how we become emotionally and cognitively absorbed with a narrative world in movies and books, investing in it more fully than the real world around us. This transportation has been shown to increase positive feelings towards to story itself. Several of my own experiences with installing character-driven attractions in existing theme parks has shown the value in gate-admission and merchandise that adding recognizable characters has on a theme park. If the addition of a recognizable brand to a park brings more people, it must mean that, for them, these choices of familiar genre, characters, and stories somehow create a rewarding experience. I believe that folk and popular culture is an extremely important tool for the theme park designer in building the emotional landscape of a park.

Although theme parks are not fully a narrative experience, in many cases they use some of the strongest tools in the narrative arsenal to create a complete and compelling world that surrounds the guest and attempts to involve them emotionally. Theme parks generally don't attempt to tell a complex story, with a few exceptions (e.g., the new *Tower of Terror* at DisneySeas, or *Hex* at Alton Towers), but rather one that is compelling and satisfying. By learning to use the emotive aspects of story in attraction design, the guest can be immersed and transported in ways that make theme parks a preferred environment that guests want to buy entrance into time and again (King, 1981).

Brenda Brown (2002, p. 267) offers even more tantalizing insights into the connection between story and rides. She believes that in many rides there is a "synchronization of turns in the landscape with turns in the story, and of the story climax with a landscape high point." The most classic example of her point may be the "old mill" log flumes, in which the flume is partially enclosed so that story scenes can be portrayed to the guest. In these flumes, the point just before the vehicle goes over a waterfall is usually the climax of the story. In *Splash Mountain* in the Disney Parks, it is when you get thrown into the dreadful Briar Patch with B'rer Rabbit before finding his happy place, and in *Jurassic Park* at Islands of Adventure, the high point is where you get attacked by, and barely escape a massive T-Rex. These rides have turns which bring the guest into new show scenes. With each show scene comes a new plot point and a new idea. The turns are intended to create a "reveal" – much like the drawing back of a theatrical curtain creates a sense of awe and new insight as the scene is revealed, so does a show scene appearing from around a bend in a theme park ride. It is both a narrative and theatrical device to draw out an emotional response from the guest.

The rhythm, motion, and space of a ride can also express its narrative and draw out a rider's emotion. One of my most memorable theme park experiences was riding an antique haunted house attraction in a now defunct Panama Beach, Florida park. The tiny ride car rode through horribly confining rooms, lurching in a way that suggested that it was liable to stop in the middle of the pitch darkness at any moment, barely controlled through its two-story ride track. I found it terribly unnerving and the scariest haunted house I had ever experienced, even though the ride scenes themselves were almost childish in their intensity. Why was it so unnerving? Humans have a survival instinct that tells us that being cornered alone in the dark in a scary place is a dangerous position to be in. This ride was exploiting that instinct to the fullest.

A good ride uses our emotional connection to rhythm, motion, and space to bring us fully into the story (Brown, 2002). When guests are terrorized by *Jaws* at Universal Studios, the famed shark's appearances are timed so that they become closer and closer together, and more and more intense. Like a good piece of music, the intensity is ramped up, drawn back to heighten the suspense (when the boat goes into the boat shed), and then the theme of danger is reprised and the intensity brought to full volume when the shark breaks through and chases the boat to a fiery conclusion. A good ride has an almost musical pacing in how it moves and how its events are presented – whether measured, chaotic, or intensifying – that correlate with the story. The coaster cars of *SpongeBob's Rock Bottom Plunge* at Mall of America lurch as if the motors are struggling to lift it up the 90 degree hill not because it was how the machinery was made, but because a smooth and gliding lift sequence doesn't bring the right intensity to the ride. The lurching motion brings more fear and anticipation to the riders as they go up the hill. The open expanse of the universe at the top of *Spaceship Earth* at Epcot is not there because they ran out of money to enclose the ride track at the top of the geodesic sphere's interior, but rather because after riding through the history of communication in much smaller rooms, the opening up of the ride at the climax into a vast expanse of projected space creates a feeling of awe which fits in with the ride's aim to inspire hope for how far we have come as humans and what we might yet accomplish. The physical aspects of a good ride – its rhythm, movement, and spaces – help express and intensify the narrative much in the same way that the editing of a film or the blocking of a play intensify the emotion of the stories being told. It turns the virtual movement and space of film into a real space to be explored (Darley, 2000). Much like film or theater, it is important to learn the tools of the media in order to tell the story in the most compelling way.

Interactivity

Over the past two decades, we have become very accustomed to the term "interactivity", but how often do we stop to think about what it means? Many Americans have become very familiar with video games, computer programs, and museum exhibits as primary examples of interactive objects. Interactivity is much more, however, than pushing buttons and getting an instant response from a computer. Interactive artworks are pushing at the edges of what interactivity can be and feel like, and technology is pushing at the edges of how we can interact with computers.

Interactivity is often defined as a communicative cycle (see figure 1.1 below). For example, Chris Crawford (2005) says that each “agent” must listen, think, and speak. The whole definition not only frames a model of communication, but it is framed around the idea that both agents must listen, think, and speak *well* in order for an event to be truly interactive. Telecommunication is interactive, as is a computer game. In both cases, you transmit a message and get an appropriate response. Also in both cases, there is a person or computer that is serving as a social entity. So by most definitions, interactivity is at the heart a process of communication.

In order to use interactivity successfully, its scope must be defined and we must explore how users react and become absorbed in interactive exchanges. Mihalyi Csikszentmihalyi (1997), John L. Sherry (2004), Mark L. Harvey (1998), and others have begun to explore how people become immersed in media (they use terms such as “immersion”, “flow”, and “cognitive absorption” to describe their unique perspectives).

Table 1 : A few definitions of interactivity

Author	Year	Ideas About Interactivity
Crawford, Chris	2005	Interactivity is “a cyclic process between two or more active agents in which each agent alternatively listens, thinks, and speaks.” (p. 29)
Downes, E.J. and S.J. McMillan	2000	Interactivity depends on different dimensions. For example, interactivity increases as participants find communication to be responsive. (p. 173)
Jensen, J.F.	1998	Interactivity is "a measure of media’s potential ability to let the user exert influence on the content and/or form of the mediated communication." (p. 201)
Kiousis, S.	2002	Interactivity involves three factors: technological structure of the media, characteristics of communication settings, and the individuals' perceptions. (p. 379)
Yuping, L. and L.J. Shrum	2002	Interactivity is: "The degree to which two or more communication parties can act on each other, on the communication medium, and on the messages..." (p. 54)
Murray, Janet (via Bogost, I.)	2007	“…environments must be meaningfully responsive to user input.” (p. 42)

Almost since the beginning, the most forward-thinking entrepreneurs in the amusement industry have considered interactivity to be an important part of their business. Concerning the industry during the early 1900s, it was said that, “experienced showmen had long argued that the best rides were participant-directed; feelings of self-directed movement, control, and choice stimulated public patronage" (Marling, 1998, p. 27). This has become no less important in the modern industry. Most heavily-themed attractions attempt to center on the guest as the key participant and character in the attraction's plot. For example, several Fantasyland attractions at Disneyland and Disney World have had the main characters, such as Peter Pan or Snow White, minimized so that the guest can imagine themselves in the main role. Modern rides that allow guests to shoot infrared guns at targets actually attempt to make the guest integral to the plot – they are helping Scooby Doo to vanquish ghosts, Men in Black to extinguish aliens, or Buzz Lightyear to restore battery power.

Now, companies are inventing ways for characters to talk back and for guests to tailor media according to their preferences (e.g., the new *Spaceship Earth* rehab, and the upcoming Universal Studios Florida *Hollywood Rip, Ride, Rocket* rollercoaster). When these technologies mature, the audience will be able to truly affect how the show unfolds, should they wish to. The feeling the guest can have of being a protagonist within the environment is not just perpetuated by giving the guest a means to control their experience and a central role in the narrative, but by empowering the guest with the ability to act and influence the characters, environment, and story around them. Now, rather than being a passive spectator, the guest is starting to be able to embark on exciting adventures that happens *to* them, rather than just *around* them.

Given that we tend to treat computers as social entities (Reeves & Nass, 2003), it could pay off handsomely to teach computers how to be more conversational. Disney has begun to see the benefits of this sort of interactivity. In 2003, they began to sell Pal Mickey: a sensor-stuffed plush that sends contextually appropriate messages depending on where in the park it is located. By telling jokes and claiming the guest as its friend, the little toy has gained quite a following.

Originally available as a rental because of its high cost (at one point, $65 per plush), so many guests left the park with their Pal Mickey that it eventually became a retail-only item. This was only the beginning of Disney's character-based interactivity. In 2004, Disney opened *Turtle Talk with Crush*, in which guests can hold a conversations with a CG puppet of the famous co-star from *Finding Nemo*. The attraction had such long lines that it was recently moved to a newer, larger theater. More projects have been developed and are underway via Disney's new "Living Characters Initiative" which is creating all sorts of puppeteered characters that guests can interact with, such as Wall-E, Remy from *Ratatouille*, and the Muppets Bunsen and Beaker.

Much like narrative, interactivity is an important factor in emotion and immersion. It might seem that screens and artificial technologies could have no comparison to physical reality when it comes to immersion. However, Baños et al. (2004, p. 739) tell us that "non-realistic displays are able to engender substantial levels presence." The mechanisms for evoking emotion through interactivity are not entirely clear at this point (Barrett, 2001), but we can gain some direction from Klimmt and Vorderer (2003, p. 354) who state that, "As long as interactivity allows for experiences of control, mastery, and self-efficacy… it will intensify the pleasure of using the media product and thus increase the motivation to experience a strong sense of presence. Besides the single moments of mastery experiences, interactive media may enable their users to enter states of flow." "Flow", introduced by theorist Csikszentmihalyi, is a state of maximum enjoyment and absorption in a task. Suffice to say that getting guests to a state of absorption and enjoyment is optimal for a story-based media.

Although the mechanisms of interactivity are not entirely clear, we may be able to find breakthroughs by taking the strengths and tools of narrative and finding their synergy with interactivity. Already, theme park operators are experimenting with new ways to interact with stories. In 2009, *Monster's Inc. Ride and Go Seek* will open in Disney's Japan park. The scant information available says that it will allow guests to play more of a hide-and-seek game with characters, rather than simply racking up a high score. Details are still developing on this ride system. On the older *Great Movie Ride* at Disney Hollywood Studios, live actors provide the potential for interaction and variation from one ride to the next. Certainly, in the future, more interesting variations will emerge that combine story and interactivity in new ways. Hopefully, this experiment will also provide some fodder for discussion in this emerging field.

Interface

Every computer needs some sort of interface that provides it with input from the outside world. The interface may be buttons, a keyboard, a heat sensor, a pen tablet, or a gesture-recognizing camera system. The point is not *what* the specific interface is, but rather, whether it makes sense in light of what the user needs to accomplish. If the interface is incomprehensible, draws attention to itself, or is difficult to use, it is a bad interface (Heeter, 2000). The ultimate goal of an interface (especially in entertainment), is to become invisible. The user works *through* the interface, seamlessly accomplishing his or her task without thinking too much about the interface at all (Schell, 2005).

There is an added burden with theme parks: there is usually some sort of learning curve when learning how to use an interface. Because of the high-intensity and brevity of theme park attractions, there isn't time for a user to learn an interface and become accustomed to it (Schell & Shochet, 2001). This is probably why so many attractions have used the gun-and-target analogy for interaction, or flashing buttons. These are interfaces that most users can understand instantaneously, which is optimal (Johnson & Wiles, 2003). However, sticking to interfaces that are extremely simple to understand can sometimes mean that the options are very limited. The theme park industry should not be limited to gun triggers and flashing buttons in order to get the point across. Instead, we should be looking at objects and interfaces that most people have daily experience with and use the visual cues from those objects to create intuitive interfaces. People know that the pages of a book turn, a rattle should be shaken, and drawers are pulled. Some theorists, such as J.J. Gibson, have called these qualities of an object “affordances”, and consider the natural intuitiveness of a technology’s interface very important to its design (Gaver, 1991). This determines whether a user can pick up the object and know what to do with it or walk away in frustration. An object that is truly integrated into its story world would hopeful be both intuitive and intriguing for the user.

Every good interface starts with some sort of sensor to turn a motion into something that a computer understands. Sensors can be pushed, pulled, bent, tilted, heated up, lit, moved through space, spoken to, and spun, while translating the information into something that the computer can understand. They are becoming amazingly fluid, allowing entirely now forms of interaction. There are even systems on the market for recognizing gestures, faces, and voices. It is not uncommon now to talk to automated call center systems. This huge variety of sensors opens up amazing possibilities to us. For example, some researchers are researching storytelling with children using plush animals that children can move around in order to direct an on-screen avatar. Theme parks such as Wannado City are using RFID to track the guests and allow parents to find their children. An RFID system could also allow the characters on a ride to recognize individual people and tailor the ride according to their preferences so that the experience can be adjusted to their enthusiasm and energy level. New types of interface could include a seashell necklace that glows for a Little Mermaid ride, or a trumpet and life-giving vial of fluid for a Chronicles of Narnia attraction. We are no longer tethered to buttons and guns. The interface can and should be an object that fits the story, allows the guest to take action at critical moments and lets them feel like they are part of the story, moving along with the characters on their journey. The interface should be natural, and allow for differences in participation. Rather than the "push this button now!" paradigm that rules *Mission: Space* and the now defunct *Horizons* at Epcot, the interface should allow for natural interaction that relies more on what the guest contributes than their reaction time.

At the University of Central Florida, a professor named Jeff Wirth has been working on new types of improv that incorporate any contribution that a guest makes in order to form a story. Any action or response, big or small, is used to form a satisfying story with conflict and conclusion. For a computer, this would be a harder task, but a rewarding one. If we can get computers to acknowledge people as individuals whose unique responses to situations are valuable and accepted, the computer will be perceived as a polite social entity (Heeter, 2000) and the interaction with it will feel more rewarding to the user.

Truly natural interfaces that require no time to learn are still being invented. But as the technology evolves, there is no reason why the more successful of these innovations can't be absorbed into theme parks, where it can be tried out on a mass international audience. There is a lot to gain from interfaces that look more like everyday objects and less like cell phones or computers. Theme parks provide a perfect context for these inventions.

Immersion

Immersion is a complex idea. It involves attention, emotion, flow, and other components that may not have even been identified by researchers yet. Douglas and Hargadon (2000, p. 154) have connected it to the idea of narrative by telling us that "the pleasures of immersion stem from our being completely absorbed within the ebb and flow of a familiar narrative schema." While the pleasures of immersion may stem from narrative, this still leaves the question of how exactly that immersion is achieved: that is, how do people become absorbed in story?

Csikszentmihalyi (1997) provides some tantalizing ideas about the nature of immersion. Csikszentmihalyi coined a term called "flow", which is the state when someone becomes completely immersed and absorbed in the task they are doing, and has provided a useful scaffold for many researchers' work. In flow, a person is completely enjoying what they are doing. According to Agarwal and Karahanna (2000, p. 666), Csikszentmihalyi's theories have been "empirically confirmed to be significant predictors of several important outcomes related to technology use, such as attitudes and extent of use." He identified specific factors that helped promote flow, and thus create a more fulfilling and enjoyable experience with daily life tasks. The specific factors that relate to technology (Sherry, 2004, p. 333) are the following:

1) Activities should have a concrete goal with manageable rules
2) Activities should be flexible so that the skill level required is adjustable. It should not be too easy for the user, not should the user be getting frustrated.
3) Activities should provide clear feedback about progress towards the goal.
4) Activities should make it possible to screen out distractions and focus on the task.

Most researchers seem to agree with these ideas (Witmer, Jerome & Singer, 2005). The best video games, for example, fulfill these rules to a large extent. Thus, people playing video games can lose track of large amounts of time because they are completely immersed in the challenge. Even social interactions fulfill these criteria to some extent with each person making concessions and adjustments in order to keep on good terms, stay mentally stimulated, keep an eye on the other person's emotional status, and choose a location that will allow maximum focus. If guests became immersed in theme park attractions, they would ask less, "How was that created?" and more often "When can I experience that again?"

From Csikszentmihalyi's ideas and those of supporting researchers, we can take to heart guidelines that any interactivity should adjust to the user, be rich and compelling enough to draw the user in, and have some sort of goal and marker of progress. Certainly, the device should not be central to the ride. Rather, as Weiser and Brown (1995) recommend, it should allow the user to switch their attention back and forth, so that at some points the device is central, and at others, it fades into the background. This way, the device begins to become "ubiquitous" – it becomes part of the ride, rather than an entity onto itself.

One especially interesting study was done at Epcot with a virtual reality flying carpet experience (Pausch, Taylor, Warson & Haseltine, 1996). The results of the study showed that while the interface components (displays, components, and control device quality) were important to guests, the background story and goals as well as the sensation of motion were far more powerful in making the guests feel immersed. The sensation of motion is a powerful motivating factor. Anyone who has longed to drive their car down the Autobahn can tell you about the thrill of being in motion. It is easy to say that, given the evidence, we should aim for more thrill, more interactivity, more narrative, and more theming so that our guests will feel completely immersed. This may not be entirely the case. Harvey (1998) did a study with museum exhibits, which studied visitors in a range of different environments. What he found was that simplicity was sometimes a blessing.

> "Visitors become overloaded by the complexity and overwhelming array of activity, information, and design detail, so that they reduce the scope of their attention. This explanation is consistent with environmental load theorists (e.g. Broadbent, 1958, 1963) who contend that when the amount of information from the environment exceeds the visitor's capacity to process all the is relevant, information overload occurs, stimulus inputs are then ignored, and negative behavioral effects may ensue… (Harvey, 1998, p. 624)

Therefore, it may be more about choosing concise and achievable goals, very specific interactions and feedback, enough theming to make the guest feel like "I am there", and a story that is compelling without thrusting the guest into a world with more lights, sound, motion, and requests for interaction than the guest can possibly process. While we can claim that modern society is used to more stimulation, one only has to look as far as Amusement Today's Golden Ticket Awards to see that things like psychology, story recognition, nostalgia, and other factors may play a stronger role than newer, better, and faster technology. In weighted surveys of theme park guests, *Pirates of the Caribbean* at Disneyland slipped in to the spot for #5 Best Dark Ride, and Disney's *Rock 'n' Roller Coaster* beat out the more psychologically intense *Revenge of the Mummy* for Best Indoor Roller Coaster (interestingly, *Revenge of the Mummy* tied with the old standard, Disneyland's *Space Mountain* and is followed by Magic Kingdom's *Space Mountain*)

(Baldwin, 2007). What this tends to prove is that a good experience is key. Above technology and wilder thrills, the most fulfilling experiences will keep their popularity even when the shine wears off the new and fancy attractions.

Emotion

> "Emotions can never run too high at attractions and amusement parks if operators want to gain a customer's loyalty, according to industry experts."
>
> Koranteng (2005, p. 1)

> "Both ITC-SOPI and RJPQ results show that the emotional environment seems to be more engaging, natural, believable, and real to users than the neutral environment."
>
> Baños, Botella, Alcañiz, Liaño, Guerrero, & Rey (2004, p. 739)

In general, the past interactive installations in theme parks have often involved video game techniques and aesthetics. There are a few exceptions, but for the most part, the rides being designed for regional and international parks are video games gone 3D where guests shoot IR guns for the highest score and story is a thin veneer that holds the experience together. Rather than involve the guest in a story, the attraction becomes a find-and-shoot competition. Rides like the new *Toy Story Mania* at Disney Hollywood Studios, *Men in Black* at Universal Studios, and the multitude of Sally Corporation rides at regional parks around the world all have the same basic game play. Since most of the person's cognitive resources on these rides are consumed with aiming and shooting, there is not much attention and energy left for observing narrative structures embedded in the environment (Lindley, 2002). These ideas about how much a user can focus on and assimilate have not only been theorized (Monsell, 2003; Handy, 2000) but have been objectively observed. According to one researcher, "…puzzles require…intellectual focus on the part of the visitor which interferes with a reverie-like absorption of the experience" (Davenport & Friedlander, 1995, p. 14). When on a regular dark ride, the guest is observing the details and piecing together strands of narrative to create a holistic perspective of the ride and its narrative. When interactivity enters the mix, the narrative often seems to become sidelined so that the guest can focus on shooting. While video game techniques are an easy way, given current technology, to integrate interactivity into a ride, there certainly must be a way to make rides where the interactivity is fused with the narrative in such a way that it integrates with it and enhances it. "In a game, the player invests in their choices, where in a story the audience invests (through sympathy and empathy) in the characters." (Barrett, 2001, p. 6) A device that can create for the guests a better emotional connection with the characters and conflicts of the narrative will also help immerse the guest more deeply into the attraction's overall narrative and theming and thus create a better overall experience.

Researcher Jesse Schell (2005) goes so far as to theorize that the human abilities that make it possible for us to enjoy entertainment and which make entertainment experiences successful are attention, empathy, and imagination. Certainly, an environment with emotional aspects is more engaging than an environment that is entirely neutral (Baños et al., 2004). We have reached a point in the history of technology where technology no longer has to or needs to be cold, sterile, and servile. This doesn't mean that we have to put characters on-screen for the guests to interact with in order to create some sort of empathic connection. There are some indications that people would rather interact with a physical robot, rather than a screen character

(Brooks et al., 2004). So it is important to consider the application and audience rather than choosing a medium at the outset. We are necessarily attuned to the physical world, and it would probably be a mistake to start putting everything onto screens just because it seems convenient or like a great cutting-edge solution. Rather, we should make compelling experiences in which the guests can either experience a part of the main character's emotional experience and see through their eyes or in which the guest, through their interactions, is reenacting part of the plot or the actions required to solve a conflict. When we make good artistic decisions that pull in the audience's emotion, the best medium for the project will become apparent. The reason that the Peter Pan ride at Disney maintains such popularity (and such long wait times) at the Magic Kingdom may have more to do with the guest's ability to experience the famous flight in the story, rather than the actual environment or sculpted characters themselves, who don't appear until halfway through the ride (Hench, 2003). You could say that guests are viscerally empathizing with the characters through their experience of flight, rather than empathizing with symbolic sculptures of those characters. Several other rides, such as *Snow White's Scary Adventure* and *The Many Adventures of Winnie the Pooh*, also have sculptures of popular characters, but do not appear to have the same popularity. If we can find other ways to let the guest feel what the characters are feeling, or become invested in the key emotional components of an attraction, the experience will be less about the guests' ability to connect with technology, and more about their ability to connect to the story itself.

As shown in the interactivity section, people tend to view computers in social ways, and interactivity reflects human communication in interesting ways. We sell the guest short when we only allow them to interact via buttons, giving them little chance to really connect with the story and characters. We are just on the cusp of a new paradigm in interactivity. Disney has devoted years and huge amounts of money to its Living Character Initiative, which basically develops highly articulate animatronic puppets. The newest, Mr. Potato Head, is able to autonomously single guests out and ask them questions (such as who their favorite Toy Story character is). Animatronics have transformed from a passive entertainment to creations that hold a conversation with the guest. Imagine a whole ride where you can speak to the characters and they will reply to you. The quest becomes one where the guest works together with synthetic animatronic characters towards a satisfying ending, rather than passively experiencing a canned performance like on current dark rides. It is probably quite cost prohibitive now, but there is no telling what might become possible in the next decade.

CHAPTER TWO: RESEARCH QUESTIONS

In the reading of this literature, there were some relevant concepts that occurred over and over again. In the course of reading, these ideas were recorded and explicated. In accordance with the methods of grounded theory and its recommendation of listing known biases, each concept that emerged from the review of literature will be explained and the relevant sources listed. These concepts will hopefully help to open up a forum for dialogue about effective techniques and "rules of thumb" that could be used in the construction of interactive devices for theme parks. These ideas, which have been gleaned from psychology, media research, and a variety of other disciplines, will hopefully form a decent starting point for future research.

Preliminary Guiding Principles

1. ***Interactivity is most engaging when it resembles a social/relational interaction.***
   Interactivity is generally defined by the various researchers as a form of communication. This is no surprise since humans by nature are very social creatures. Some studies have even shown that we (at least on a subconscious level) treat computers as if they had motive and emotion (Reeves & Nass. 2003). According to Reeves and Nass, we tend to treat computers with a similar politeness that we would use with people, and we regard a computer differently depending on factors like apparent gender and personality. Some of the most successful interactive installations at theme parks to date give the guest the illusion of conversing with a known and beloved character (i.e. Pal Mickey, *Turtle Talk with Crush*, *Monsters, Inc. Laugh Floor*, and the Living Characters Initiative). Even in everyday live, our GPS devices have been given more human-like voices, and errors on

our laptops tend to say “Sorry, this program cannot continue and must close” rather than the old-fashioned “Error 404” which makes no sense to most human operators. Making computers more “friendly” and easy to interact with is a trend in computing that has made modern life, which surrounds us with computers, easier.

It is important to note that interaction not only occurs between the human and device, but also between the device and the ride environment, and between the human and the people around them. This is especially important for a theme park. People tend to go to theme parks with friends or family, with the purpose of enjoying time together. Technology that isolates one person from another is likely to be unwelcome in a theme park. The technological advances of the past: airplanes, telephones, televisions, printmaking, and other great technologies were closely related to the desire of people to communicate with one another In general, the newer technology trends – PDA cell phones, text/photo messaging, skype, blogging, Microsoft’s interactive table, and RFID – probably have enjoyed the attention and popularity that they have because they bring people together. While it is difficult to encourage or predict person-to-person interaction, this type of interaction may very well be important to people’s enjoyment of interactivity (Cooke, 2005; Gilsdorf, 2006).

2. ***A gadget should not engage the guest’s entire attention (especially during key segments of the ride), but rather should enhance the ongoing narrative and atmosphere.*** Many studies support the idea that humans can only pay attention to a limited number of stimuli concurrently. The main proponents of this idea have created a theory called “cognitive load”, which states that human beings have a finite amount of cognitive resources available. If a certain task takes up most of a person’s mental resources, they have little

left for additional tasks at that time (Schell, 2005; Monsell, 2003; Handy, 2000). A ride surrounds a guest with dynamic audio and visual stimuli. If the gadget provides full-fledged audio and video as well, then the guest has to decide whether to pay attention to the device or to the environment. This means that they are not getting a full experience of either the device or the ride, unless they are good at screening out the stimuli that they wish to ignore. The designers of *Spaceship Earth* at Walt Disney World in Florida attempted to solve this problem in their recent rehab of the ride. They added video screens in front of each bench in the ride vehicle. The video screens light up at the beginning of the ride as the vehicles ascend through a darkened tunnel, and then are dark for the portions of the ride that involve elaborate sets and animatronics. The original ride included beautiful starscapes, color-changing tubes of light, and dioramas when the vehicles turned backwards to make the final descent. In the rehab, the dioramas and color-changing tubes were stripped out in favor of tiny lights and mirrors to create a very regular starscape. During this final sequence, the intention seems to have been for guests to pay attention solely to the screen while they answer the questions that create a unique video for the guests. While some guests enjoy the new interactivity of the ride, others have lamented that it seems anti-climactic after seeing the elaborate sights, smells, and sounds that make up the first 2/3 of the ride. The designers may have been able to maintain the sense of richness by adding ambient animation and sound that enriched the guest's sense of being in a fully fleshed environment (even if imaginary and abstract) while in the final descent.

Even on a daily basis, our ambient environment can have key effects on our emotion and behavior even if we are not explicitly paying attention to it (seasonal affective disorder being one extreme example). Our brains switch from filtering the ambient environment to full attention when an unexpected stimulus (e.g. loud noise, sudden movement, or strong wind) comes into play. The key is to find a balance or a way to segue from screen-centric moments to environment-centric moments fluidly.

An interactive device can take center stage or be peripheral and complementary to the other elements of the attraction, depending on the needs of the story. This would be an admirable goal for interactive media: to complement, rather than compete, with the environment.

3. ***The interface should be intuitive and seamless, requiring almost no learning curve.*** Guests often have a lot of distractions in a theme park and are often impatient and looking to relax. So it is important to make attractions as simple as possible to decrease what a guest has to "invest" to take part in that attraction. Guests do not all have the same learning capacity, language barriers may be present, and a fear of technology may hinder them due to lack of experience. Providing natural interfaces lowers the learning curve so that nearly anyone can enjoy the device without spending the whole ride trying to figure out how it works (in which case, most people would probably give up and become passive).

4. ***Action needs to be followed by an appropriate reaction. Reactions should be varied to help maintain the audience's interest.*** Psychologically speaking, if we are not rewarded for our interaction, we are less likely to interact altogether. This was part of the ideas of B.F. Skinner, a prominent behavioralist. When a device provides the same reaction every time (called "continuous reinforcement"), it not only fails to appear social (a condition that we should strive against in interactivity) but it fails to provide the intellectual or

emotional stimulation that encourages repeat interaction. Our brains are fascinated by novelty, and this drive causes us to play and explore from the time we are born. A device that reacts predictably and fails to provide anything novel will most likely be relegated to the role of "tool", rather than a key element of story, play, and entertainment. As discussed in the first guideline, humans seem attracted to computers in a way that subconsciously mimics social interaction, and this potential for enabling computers to become characters in a story or the tool through which guests become a character in the story poses a fertile area for future study because it allows guests to engage in such an emotional and imaginative way. What this means by proxy is that the computer, in order to be consciously or subconsciously perceived as a social entity, should be designed so that it does not react in an absolutely predictable and analogous fashion to every input that it is given. At the same time, its reactions should make sense within the framework of a given personality or idea that guides the story and also not be so mysterious that guests cannot "figure it out".

5. ***Interactive devices should have compelling visual, auditory, and/or tactile feedback.*** Most media that are popular in modern society provide heavy visual and auditory feedback in exchange for low effort. For example, in a film theater, we sit still, face forward, listen, and watch. In exchange for sitting still in a darkened room, we are provided with rich, large-scale visuals, and surround-sound audio. Video games serve a smaller segment of society – they require more physical and mental effort than television, literature, or film. Because interactive devices *do* require some effort, they should provide plenty of visual or auditory reward. If possible they should also provide

emotional resonance. By giving the guest auditory and visual stimuli in response to their interaction, you are rewarding them for their extra effort.

How do we prevent sensory stimuli from upstaging other elements in the ride? The key is most likely to either mesh the reactions of the device with the conflict going on in the environment, or to have the device reactive during parts of the ride where little other audio/visual feedback is happening. This aspect of the problem will require more artistry and experimentation to solve.

6. ***Interactive devices should reiterate the central theme of an attraction.*** Joe Rohde is a veteran designer for Walt Disney Imagineering, whose credits include leading design of the Animal Kingdom park in Orlando and pushing the creative envelope for *Expedition Everest*. Rohde (2006), as well as his well-venerated colleague, John Hench (2003), both emphasize the importance for each attraction and area of a park to have a singular theme and cohesive voice. Having both played key roles in designing some of the most popular theme parks in the world, these are men whose best advice should be taken to heart. If they are so careful as to make sure each color and detail is in keeping with the theme and world of an attraction, any interactive device that is installed in these worlds should be no less carefully analyzed and designed (Harvey, 1998).
7. ***There should be a concrete goal which provides some sort of challenge to the participant and clear feedback to the participant about the effects of their interaction, and their status with respect to goals or the story in general.*** This guideline is related to research concerning “flow” by Csikszentmihalyi (1997). Many of our daily tasks provide a goal and feedback. When we do the dishes, we can see our progress and how well we are accomplishing the goal of removing all dirty dishes from the sink. If there is no goal

or feedback, we are likely to become frustrated. A never-ending task at work does not feel satisfying until we feel like we are nearing the end. Many of the devices around us, from microwaves to e-mail to magazines, give us immediate feedback on how far along we are on our task. If we want people to keep interacting, we should let them know what they are trying to accomplish and if their effort is making a difference. For example, IR shooting rides have accounted for this by giving the guests a running tally of their score and giving them a chart at the end of the ride to compare their score to. Conversational interactions like *Turtle Talk with Crush* give social cues as to the length of time and number of interactions that Crush will be available for. It also gives guests the purpose of finding out about Crush’s world and helping him learn about ours. These goals and gauges help guests to “locate” themselves within the story world and understand what to expect as the ride or show progresses.

These guidelines are the result of studying other disciplines and fields. Hopefully, in the future, there will be more experimentation on how interactive devices should be integrated into story and what guidelines are appropriate. As we learn what works and how to engage an audience, we can create deeper and more endearing experiences.

CHAPTER THREE: CREATIVE EXPERIMENT

Theme parks are a unique and fascinating venue. Theme parks as we know them have been around for over 50 years. Dark rides as we know them have been around for about a century. The challenge of artists in each generation is to make something that is fresh, relevant, and new. Each artistic style of the past, be it Art Nouveau, Rococo, or Cubism, took a familiar style and twisted it into something new and interesting that came to define that time period and culture. Theme parks in the same way have bent and changed in order to serve each new generation. With so much behind us, it is easy to think that everything has been done. But indeed, with new technologies before us, there are new modes and styles of art waiting to be discovered.

Re-invention is part of the challenge that theme parks have ahead of them. Maintaining attendance levels means giving people a reason to come back: more thrilling rides, new shows, and new special events. (Even in the pleasure gardens of Europe in the 16^{th} and 17^{th} centuries, new shows with new special effects and fireworks were part of the formula to keep patrons coming back, along with cleanliness, beauty, and keeping advertised standards (Mitrasinovic, 1998).) It is likely that, in the next 50 years, theme parks will change a lot in how they attract and maintain their audience. In the past, it was artists and forward-thinkers who created successful revolutions that resulted in the amazing worlds that we know today. Hopefully, there are more artists and entrepreneurs waiting in the wings to make fresh, new, and amazing experiences.

For this experiment, I have chosen a ride that has suffered from a lack of ridership. Almost any time of day, there is relatively little wait (Neal & Neal, 2007). This is unfortunately not a boon to the theme park. When there are tens of thousands of people in a park at one time, the rides and queues are arranged to draw in large numbers of people so that the walkways, eating establishments, and resting places in the remainder of the park aren't so crowded that they are uncomfortable. Ride designers carefully calculate the "throughput" of a ride (how many riders per hour it can take), so that they can predict how it will affect the flow of people through the park. If people wait too long in line, they will be unhappy, but if the sidewalks are extremely crowded, they will be unhappy as well. So the rides need to do their work of drawing off enough people to keep crowds in control, keep people moving, and keep them happy.

When I first rode *Journey into Imagination* at Epcot as a child, it seemed magical, scary, beautiful, and interesting. It went through several literary genres and ideas, showing how imagination is sparked within us. The ride has changed forms drastically since then, and the lush show sets have been cut back. In 1999, the ride was modified and the track was shortened drastically so that the formerly 11 minute ride was now around only 5 minutes (Wikipedia, 2007). The 1999 revision that they made anecdotally received many guest complaints. In this version, the guests' brains were "scanned" at the beginning of the experience, and after it was determined that they were void of creativity, they were taken through several experiences in an attempt to fill the gap. When executives rode the ride, they told Imagineers that they needed to make some major changes. That's when the 2002 version of the ride, which is currently in operation, came into existence (Wikipedia, 2007).

The ride story of the new version is that we are taking a tour through the "Imagination Institute", a fabricated haven for maverick inventors. Our host, Dr. Nigel Channing, warmly welcomes us as our tour vehicles enter the facility. From the very beginning, a little dragon called "Figment" begins to wreak havoc, and after we tour through the Sound, Sight, and Smell labs (with Figment interfering each time), the good doctor tells us that he is nervous to take us through the Taste and Touch labs so he will have to send us back to the Institute. Figment tells us that he knows a short-cut, and takes us through his own very colorful and very upside-down house. (See Appendix C for ride photos.) After the Dr. comes back to wrap up the experience, he tells us the imagination is better when it is “set free”. Suddenly, a wall opens up, showing Figment in an astronaut helmet, painting, and doing many other fantastical things. The vehicle then proceeds to a starry room, where the lights come up to reveal the unload area.

I choose this ride for several reasons. Firstly, because it is appropriate for all ages. The ride does not require a lap bar nor does it have height restrictions. This has a three-fold advantage. Firstly, the ride is suitable for all ages and is unlikely to induce motion sickness when subjects watch a video-recording of the ride. Secondly, it has some relatively quiet moments between its moments of activity. These are moments in which the guest’s attention may be drawn back to the device without distracting from major story points. Finally, the ride is relatively unpopular. This means that it is easy for me to ride over and over in order to understand the ride’s story structure and cadence. This also means that I did not have to compete with a nearly perfect story and audio to try to make the experience even better than it already is. Some rides are a nearly perfect experience without interactivity. Other rides might benefit from the addition. In this case, interactivity would probably be a benefit.

The purpose of the current study is to gain some feedback on the initial prototype device, so that further development might be pursued in the future. My hope is to eventually develop an experience where the ride and device mutually enhance each other in regards to the guest experience.

This leads me to the design of the device itself. Many of the theme park attractions that feature an interactive component rely on “shooting” or “seeking” using an interface shaped like some sort of gun or flashlight to rack up a score. There are a few that rely on buttons, but they are generally “one-off” attractions. In Orlando alone, three relatively similar shooting attractions exist: *Buzz Lightyear’s Space Ranger Spin* at Magic Kingdom, *Toy Story Midway Mania* at Disney Hollywood Studio, and *Men in Black* at Universal Studios. Sally Corp., a leader in the industry, has installed 17 of these rides worldwide according to their website (keep in mind that parks do not make such a big investment very often). There are undoubtedly more of these attractions in existence, since several other major amusement hardware manufacturers also produce these rides. These shooting attractions rely on the allure of gameplay and competition to attract guests. As Sally’s website (www.sallycorp.com) says, “It is all about the game… the competition… and, the immersive environment.” These types of rides are much less about the story, because the guest is busy looking for targets, and shooting as many as possible to get a high score. Because of this, little story is needed in order for the ride to remain cohesive and interesting.

It is possible that the competitive gameplay is enough for the guest, but I doubt it. Since their inception, theme parks have engaged guests’ emotions as well. The early turn-of-the-century parks at Coney Island in New York engaged guests by shocking them with amazing spectacles like fiery buildings or an electrocuted elephant, engaged some sense of sympathy or wonder with the baby incubator displays and Lilliputian villages, tested their courage and fear with scary roller coasters and rides that took them on harrowing journeys through Hell or whirlpools, and even thrilled them with rides that aroused desire and romance as riders alternately had their skirts whirled above their ankles and traveled through slow and beautiful dark rides. This emotional connection seems no less valid today. As just one example, Disney cashes in, especially in their fireworks and parades, on the guest’s love for dreams come true, family connection, kindness, hope, and a world where everyone gets along. These values are infused into their advertising, environments, and stories. Each park in the business sells their park as an experience, rather than a product. They are selling to the consumer the emotion and excitement of being in a very different environment that stimulates their senses. Allowing people to become enveloped in story and emotion seems to be still as valid as it was when theme parks were first being created, despite all of the technological advances.

That is the reason that this thesis was written. It seemed like, for many years, that interactivity was being used in only one way: to foster competition amongst guests. When story and emotion are so important, it seems like there must be a better solution for how to engage guests. The device that I created is about allowing guests to attach to a character. While that character is rudimentary because of the nature of the technology, every journey starts with a single step. In this case, I want to start to engage fellow designers' and hobbyists' imagination with the possibilities. If they say, "I can do one better than that," I will not be insulted as long as they try for themselves to create new experiences that draw guests into a story. This is the start of a discussion that hopefully will not end until guests are able to experience such amazing and compelling experiences that the story seems absolutely authentic, unforgettable, and desirable, like a favorite movie or song that they want to play again and again. Theme parks have not truly reached that level of experience, or if they have, it has been inconsistent at best.

In designing a device, I strived to stay true to all seven of my original guidelines that I arrived at through intense study, creating a device that fulfilled each criteria in a basic way. The intent was to "shake up" just a little bit how we think about interactivity on dark rides by making something that is very different from what is currently being done but at the same time is in harmony with the psychology of how people exist within that space.

CHAPTER FOUR: RESULTS AND DISCUSSION

At this point, it would be beneficial to discuss the actual experiment and what insights resulted from this study. The aim of the study was to draw in about 10-15 participants to play with the device while watching the ride film, and to capture their feedback. In any design process, feedback is invaluable. Even Disney, with its culture of secrecy, has run tests for its Kim Possible Experience and Aladdin Carpets for DisneyQuest with small audiences while making design revisions (Pausch, Taylor, Watson & Haseltine, 1996). Sometimes guests or test subjects, being more distanced from the design effort, can provide incredibly insightful and astute observations that the designer didn't even consider, having been too close to the design process. First I will talk about the study itself and then about the results and responses of the subjects.

Overview

In order to discover how a device might enrich the storytelling aspect of a theme park ride, I created a stand-alone device suitable for use on an actual ride. The device was created using an Arduino microprocessor and a prototyping shield created by Adafruit Industries, along with a variety of sensors and output components. The device was presented to guests as a plush animal character which they could interact with throughout the presentation of the film of the Journey into Imagination ride. The guests were then asked to fill out a survey about their experience.

This preliminary study aims to look into the realm of abstract devices for theme parks: devices that are not shaped like guns, flashlights, computer screens, or other tools that we use in daily life but rather, like characters, props, and other assets from the world of story. There are many possibilities and “rules” for using interactive devices that have not yet been discovered. These miniature computers are in their infancy, relatively speaking, having only been around for a matter of decades. As these devices creep more and more into book stores, grocery stores, theatres, and home management, we will undoubtedly understand them better and become more adept at designing experiences with interactive devices that enhance our enjoyment of entertainment. Hopefully at the same time, we will be able to create experiences that have compelling emotion and story resonance. Time will tell.

Device Design

For this experiment, I chose to use a stuffed animal. I felt that I needed a face that subjects could see and project emotion onto, as well as a device that didn’t compete with the cartoonish main character, Figment. A bat is a good “mad scientist” creature for a fun laboratory setting, fitting somewhat with the ride premise and there are many ways to hold and manipulate its body. It also provides good opportunity for further study, since it could also fit into some very different rides, such as Soarin’ or Haunted Mansion without breaking the storylines.

In addition to the Arduino Diecimila microprocessor, LEDs, flex sensors, a piezoelectric buzzer, a photocell, and a vibration motor (often used in cell phones) were wired together and embedded into a stuffed animal. The circuitry diagram for the device is as follows.

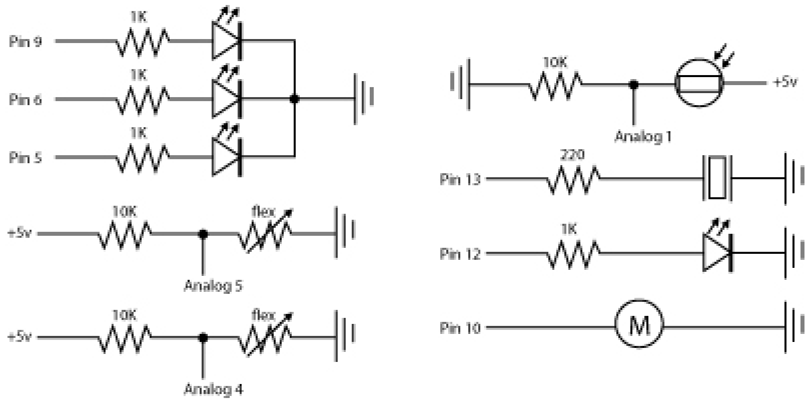

Figure 1: Arduino circuitry diagram

The photograph below shows the plush animal with the Arduino processor, a large rectangular piece which hangs near the bottom of the photograph. Moving clockwise, there is a black battery case, a yellow flex sensor, a black piezo buzzer, a cluster of three ultrabright LEDs (red, green and blue), another flex sensor, and a taped-up ping pong ball which houses the vibration motor (to keep it from getting tangled in the cotton stuffing). The two flex sensors were slid into pockets in the wings. The piezo buzzer was embedded in the head, along with the photocell (not shown). The ultrabright LEDs were slid into a hollowed ping pong ball that was sewn into the chest, which helped diffuse the light of the LEDs and provided a surface to attach a lighter piece of fur to (the original fur being too dense to shine light through). The battery case was also slid into the chest, and the vibration motor was seated below it in the abdomen. Once all of the pieces were in place, the body was padded out with cotton stuffing and the skin was fastened shut. The result was a solid but soft toy. The microprocessor, which did not fit into the body, was covered with a plastic casing which was covered in fabric and made in the shape of a backpack. This securely protected the microprocessor and wiring, but also slid off at a moment's notice, in case all of the wiring needed to be accessed. With all of the wiring fastened down with electrical tape, and each connection soldered, heat-shrink wrapped, and taped, the configuration was very stable for subjects to handle, and the device performed reliably and predictably. During experiments, the skin was merely unhooked to flip the on/off switch on the battery case and then the skin was hooked back together. As you can see from the other photos below, the finished product has no exposed wires that would catch on clothing or pull out from being handled.

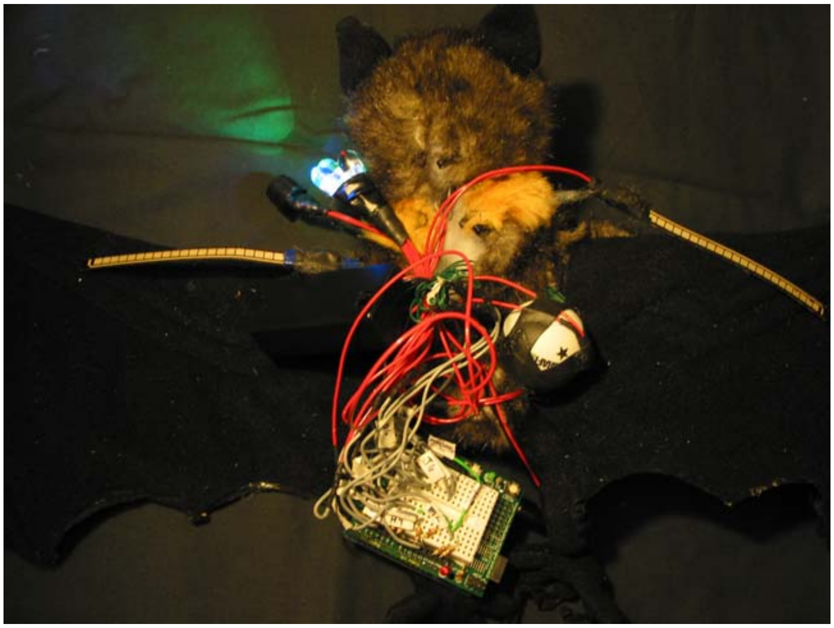

Figure 2: Device with sensors and microprocessor showing

Figure 3: Finished device (front view)

Figure 4: Finished device (side view)

Figure 5: Finished device (back view)

The other important part of this device was the programming. The Arduino uses a version of the Processing language, which allows the programmer to turn components on and off, and read sensors quite easily. For this device, the sensors were read via analog means by the Arduino and the data gathered by the sensors were processed by a variety of if/else statements which would check if the values read were above or below a certain threshold. The specific program is available in Appendix B. It was based very roughly on behavioral programming, in which a device develops a "personality" from discrete behaviors and chunks of code.

The main loop of the program senses the light in the room. If it is dark, the device increases a variable called "anxiety". If anxiety reached a certain level, the LEDs go from the default blue/green color to a bright red, and the device shakes to indicate anxiety. The program also checks how the device is being held each time through the loop. Two flex sensors in the wings monitor if the wings are bent or straight. If the subject has the device face-down in their lap, the wing sensors are unbent and the device's "security" variable decreases as if it were feeling unprotected or neglected. Likewise, the security variable decreases if the device is held by the ends of the wings, with them outstretched. But if the wings are held with the subject's hands close to the bat's body, or with the wings wrapped around the bat, the security variable increases as if the bat were feeling more secure. Periodically, the device checks the value of both the anxiety and security variable and makes a specific response based upon its "state". For example, if it feels very secure and not very anxious, it makes a noise that sounds happy. If it feels insecure and incredibly anxious, it shakes, has the red light on, and makes a very mournful sound.

Initially, I was imagining a device that responded to specific events in the ride sequence. However, the problem seemed increasingly thorny, since the timing would have to be synchronized precisely with the ride system, and most microprocessors do not seem to have a chronometer natively installed. According to the research that I did, a specifically-ordered chronometer has to be soldered in, programmed, and then the software program has to be created to recognize information from the chronometer (and this doesn't begin to touch on how to calibrate the microprocessor's chronometer with the ride timing). In the end, behavioral programming seemed a more elegant solution, since devices programmed with this method often seem to respond in a complex manner to stimuli around them, even though in reality their programming is very simple.

Testing

Grounded theory may best be described as "'the discovery of theory from data' rather than with the testing or verification of existing theories" (Martin & Turner, 1986, p. 154). Rather than starting with a research question and then gathering data, data is used to develop research questions, hypotheses, and theory. The research focus guides how data will be collected and what type of data will be collected. In harmony with this method of discovering theories, no hypothesis was ventured at the outset of this experiment. Instead, as recommended by Rennie (1998), existing ideas on the topic were listed at the outset so that biases could be avoided.

The burden to create theory from data is centered on how the data is created and handled in order to identify meaningful relationships within the data. Whenever a meaningful relationship or pattern is found within the data, it indicates a possible correlation that should be explored further in subsequent studies in order to confirm and identify the details of that relationship. This method of developing theory can be powerful, since it uses real-life research and data gathered from myriad sources in order to develop ideas, rather than developing ideas simply from reading, research, anecdotes, and thought. It also allows useful information to emerge from loose, qualitative data, enabling the researcher to use many rich methods and sources to gather data. Grounded research attempts to take into account everything that happened in the course of research, and uses the methods of memoing and categorization to begin to develop relatively un-biased ideas from that data set (Rennie, Philips & Quartaro, 1998). As the analysis of data progresses, words and phrases are appended to the different sets of data that describe the data in the broadest terms possible. From these words, concepts begin to grow and take shape. In this particular study, data was gathered from only one source, which has limited the scope of the theory that can be ventured, but the data did suggest some interesting correlations that would be useful to explore further in the future.

Because it is difficult to operate a controlled study within the confines of a working theme park (for many reasons), the study conditions attempted to emulate what a guest would see and hear while on a dark ride. A high-resolution television screen in front of the subject gave them a feeling of motion and portrayed the environment of the ride as it would be viewed by a person riding the actual ride. The lights in the room were dimmed so that the subject's focus would be on the television screen, and the device was given to them prior to the film's beginning, once they were seated.

In accordance with IRB requirements, each test subject signed a consent form in order to participate in the study, as well as a motion sickness survey to ensure that the viewing of a moving film would not cause any undue discomfort for test subjects. If any test subjects had scored highly on this survey, they would have been asked not to participate.

After they had viewed the film, each subject filled out a survey. The survey attempted to measure the guest's immersion into the attraction. Data analysis progressed according to the requirements of grounded theory. All of the data was gathered together, compared, and categorized. Notes were written concerning observations about the categorization and patterns found in the data. Once all of the steps of grounded research were completed, the connections and patterns that were found were written up into a formal set of ideas which will be explained and expanded in the next chapter.

CHAPTER FIVE: CONCLUSION

Data Analysis

Data was collected and analyzed in several ways. The surveys that each participant filled out served as a primary source for data. I looked for how the data was clustered for each question and then compared surveys that had a similar answer for a particular question to see if there was any pattern to how they answered other items on the survey. I also tried to see if there was any pattern between how they answered survey items and how they responded to the essay questions and on the survey overall. This provided an interesting grouping of patterns which I could then relate back to observations made of participants during the actual experiments. In some ways, it would have been useful to have a larger sample. However, I found the feedback of the participants that came into the study to not only be very interesting, but to provide good direction for a version 2.0 of the device. In that way it was a very successful research study. The question of how to make a story interactive is far from being solved. A comprehensive model of how to integrate interactivity with narrative in the theme parks could take over a decade to develop. Adding a real space and real movement through that space adds extra complication to how interactivity should work. Movement may mean that it takes less in order to satisfy the participant with interactivity (because they are already somewhat satiated with the sensation of motion through space). However, the relatively short length of the experience (in this case a 5-minute video of a real ride) leaves very little time to set up a story or create a connection with the audience.

One of the specific responses that came up several times in the surveys is that it would have helped participants a lot if the device had some way to respond to discrete events in the ride. This was something I had an intention to do at the outset, but it then proved increasingly challenging to figure out how to make that happen and I tried to explore if there were possible ways of creating an intriguing connection with the guest without it. The guest did connect with the device, but not exactly in the way I expected.

Most guests, even though handed the bat so that it was facing towards them, faced the bat towards the screen for the entire video, as if it were watching the video with them. There wasn't really much face-to-face interaction as was expected. Rather, they seemed more interested in the bat watching the ride with them, and responding to what they were seeing. There is quite a balancing act that needs to happen here: the participants that enjoyed the experience the most seemed to connect with the idea of a character. At the same time, however, many participants want an interaction that can be "figured out" and also a character that responds to the ride. This means that the participants are indicating that they want a character that responds to them, responds to events within the ride, and also is governed by its own personality and logic. From a programming standpoint, this could become a virtual nightmare to get the device to listen and respond on each of those levels.

The solution may come from one of the guidelines (which was also reiterated by one of the participants): it is hard to focus on both the ride and the character at once. The focal point should be the ride, but when the ride gets slow (i.e. there is not much going on visually or in the soundscape), then the device should come to the forefront. Once the timing of the ride has been nailed down, then the artist can decide for each small segment of time that the device becomes the focal point, which aspect should rule the interaction: the ride events, the participant's interaction (cause/effect), or the device's own character personality/logic. After that, programming becomes much simpler.

These three facets of interaction also appeared in the participants written answers:

> "I enjoyed the interactivity with the "partner" more than the ride itself. I wanted to know how it was going to react to each scene."

> "Ride specific reactions could bridge the attention between the character and the experience."

> "If the bat responded directly to part of the narration it might draw the rider more into the experience by establishing a link to what happens in the ride/narration and what happens to the bat."

These and other responses indicate that, while they are interested in the character, they also want the device to respond to the ride. Several subjects also commented that they had difficulty trying to "figure it out". The way that the device reacts to everything going on around it and to the guest, must make immediate sense to the guest.

Another interesting pattern came out of observations of the participants themselves, and how they responded to the survey essay questions. Around 50% of participants observed handled the bat with behaviors consistent with how a person would hold and handle a small child. They would cradle it, bounce it when it was upset, pet its stomach, say reassuring words to it, etc. It was expected that a good number of participants would treat it as a "thing" and lay it down on their laps, leave it leaning against their stomach, hold it by the ends of the wings, or just grab it with one hand. However, participants almost without exception cradled it, held it against their body or held the wings with their hands close to the bat's body. There was very little "thing" behavior observed other than turning it around in an attempt to vary the response they were receiving from the device. It was also expected that participants would see how many different responses they could get from the device. For example, how upset would it get if they put it on the floor or confined it? No participant was observed to experiment in this way, however. Overall, even the participants who weren't very active seemed concerned if the bat remained in its "scared" state for most of their experience. Participants who were active would try various consoling behaviors to get the bat back to its calm state.

Perhaps because of how the participants were prepped, using emotion terms such as "scared" or "happy", the participants treated the bat with a more social attitude that indicated that they were unsatisfied if the bat was scared. Participants noted that they became tense when the bat was scared and put energy into trying to figure out how to calm it down. Some of their comments indicated a desire to have more story and character background to help them understand the character. Overall, this behavior deviated from what would be expected if the bat was viewed as simply a device and it didn't matter how it was treated. This corroborates what Reeves and Nass (2003) have said about humans treating computers as social entities, and should have consideration in how an interface is ultimately designed. (In this case, I would have been wise to place touch sensors in the wings, forehead, and stomach since these were the areas that participants most often stroked when trying to console the creature).

The other factor that might have affected results is the age of the participants. The subjects who came into the research study were all of college age. This generation, having grown up with computers, may have a different reaction and mental model of technology that those before or after them. As observed by Turkle (2001) in her decades of researching the topic, children who grow up in the new age of technology (in which technology is more software-based than mechanically-based) tend to understand technology more in terms of psychological models and systems behavior than a top-down, centralized, cause-effect model that is more common to the generations before them. This means that the tendency to treat the bat as a creature or small child in how it was handled and spoken to may have something to do with previous childhood experiences with technology. There may be a sort of "black box effect" in action: Turkle noticed that as technology became more indecipherable mechanically, that the mental models used to understand technology became more psychological and abstracted. Reeves & Nass (2003) observed that people, in general, tended to at least be polite and work with computers in ways similar to how they would work with another person, if the computer presented itself in a way that was more complex and conversational than a utilitarian tool. It could be that when an object's responses become more complex than cause and effect, and there is no way for us to easily take the object apart in order to analyze how it works, that we begin to ascribe psychology to it in order to ease our interaction (and when psychology fails and the object proves to be just plain erratic, like when a talking toy begins to short circuit, we just throw it out). In this case, if the participant couldn't figure out what specific things frightened the bat (i.e. if they were trying to correlate the bat's behavior to specific events or characters), they became frustrated. On the other hand, if they "figured it out", or if the bat was happy for most of their interaction (which is the goal for most social relationships), they seemed to feel vindicated, or satisfied. Whether the participants' reactions were related to their age or previous experiences with technology remains to be studied. It is possible as well that personality, confidence, willingness to experiment, and whether we are being observed by others effects how and to what extent we engage with technology in an emotional and social way.

Each participant, after they were observed interacting and watching the entire video with the bat, was given a survey to complete. The survey items were extracted from Witmer, Jerome, and Singer’s (2005) Presence Questionnaire, which they developed by building upon previous research questionnaires and testing each item on the questionnaires for validity in laboratory experiments. The survey results obtained in this experiment were extremely varied. Color has been added to the table below to more actively show how the data clustered. Yellow spaces mean that only a few participants answered that way. The closer a color is to dark red, the greater the number of participants that answered that way.

Table 2 : Survey results for 14 subjects

	Competely	Mostly	Somewhat	Only a little	Not at all
1. How much did you feel you were able to control events?			7	4	3
2. How natural did your interactions with the ride seem?	1	3	7	3	
3. How much did you feel that the device contributed to your feelings of being immersed in the story world?	1	4	4	5	
4. How compelling was your sense of movement through space?	1	5	2	4	2
5. How proficient with the device did you feel at the end of the experience?	2	3	7	1	1
6. How completely were your senses engaged in this experience?	2	4	7	1	
7. Overall, how much did you focus on using the device instead of viewing the projected media?	1	9	3		1
8. Were there moments that you felt completely focused on the screen environment?	2	4	1	5	2
9. To what extent were you distracted by events occurring outside of the experimental media? If so, explain those events below.		1	5	3	5
10. How much did you feel a part of the experience or connected to the characters?		2	8	4	
11. How much did you enjoy the experience overall.		7	6	1	

Answers tended to cluster towards the middle, with some interesting exceptions. For example, on question 7, the answers indicate that participants focused more on the device than on the projected media. It is possible that when participants are on an actual ride, this answer will become more balanced: that they will focus more on the ride than the device. There is definitely some deficiency in using a video recording. However, it is worth further study because interactivity may naturally compete with the external environment. If that is the case, it will have to be addressed with extra care each time an interactive element is introduced into a ride so that one will not diminish the other. Ideally, a connection between device events and ride events might make the participant feel like they experienced both more vibrantly than they would otherwise.

As could easily be predicted, those participants that were distracted by extraneous events in the room (sounds or events in the room that were spontaneous and difficult to control) seemed to have less enjoyment of the experience and overall had widely varying responses across the survey. On the whole, they were less likely to feel connected to the characters and less likely to feel in control of events. None of the participants identified specific distractions, but they were likely related to regular activity within the building (which contains classrooms and public spaces) and as well as to regular activity within the lab space itself. The lab was as quiet and non-chaotic as possible, but there were still a small number of interruptions during the course of the day. This experimental condition highlights why dark rides, out of all possible rides, are well-suited to interactivity: dark rides are a well-controlled environment where everything is isolated and designed, and all distractions are carefully screened out. However, it should also be noted that the relationship may go the other way: a subject who is not enjoying the experience may be distracted more easily. This is a more difficult problem to solve.

Perhaps the most interesting pattern is that those who felt that the device contributed to their feelings of being immersed in the story world also seemed more likely to report that their feeling of movement though space was compelling, more likely to feel like they had moments of complete focus on the screen environment, more likely to feel connected to the characters, and more likely to enjoy the experience overall. I do not have a total explanation for why the surveys that had more positive responses for question #3 had overall more positive responses on so many other questions. These responses indicate a stronger immersion into the media. I think it would be interesting in the future to explore this idea further to see if, indeed, a well-designed device can improve a ride experience and feelings of connection to story and character compared to the same ride with no interactive component.

Re-examining Initial Biases

In many ways, the research confirmed the biases, or guidelines, that developed during the research stage. I will reiterate the guidelines and then discuss how they relate to the results:

1. ***Interactivity is most engaging when it resembles a social/relational interaction.***
2. ***A gadget should not engage the guest's entire attention (especially during key segments of the ride) but rather should enhance the ongoing narrative and atmosphere.***
3. ***The interface should be intuitive and seamless, requiring almost no learning curve***
4. ***Action needs to be followed by an appropriate reaction. Reactions should be varied to help maintain the audience's interest.***
5. ***Interactive devices should have compelling visual, auditory, and/or tactile feedback.***
6. ***Interactive devices should reiterate the central theme of an attraction.***
7. ***There should be a concrete goal which provides some sort of challenge to the participant and clear feedback to the participant about the effects of their interaction and their status with respect to goals or the story in general.***

Participants in the project seemed much more interested in the bat as a character than in how it actually works. I had several people who wanted to know “what made the bat afraid” or why it reacted in certain ways. Only one subject, who specialized in computer work, asked what technology I was using. This indicates that participants were much more interested in the bat as a character than the bat as a piece of technology. A couple of participants wanted the bat to have a name and a deeper story. Along with their observed behavior when interacting with the device (talking to it, stroking it, and carefully holding it), this seems to indicate that what interested and engaged the participants was more along the lines of relational, social, and imaginative aspects of the device, rather than its status as technology. This supports the postulate of guideline #1.

Guideline #2 was supported by the comment of one astute participant directly, as he commented that there should be times for the participant to focus on the device when the surrounding action abated, alternating with time of focus on the environment. It was also supported by other participants who indicated that they felt like their attention was split too much between the device and the screen, trying to absorb both in full. Further study would be needed in order to understand how much device interaction is necessary for a satisfying experience, as well as what strategies could be used to gracefully segue the participant’s attention from the environment to the device and back.

Some participants had a bit of frustration with the device. Although some participants intuitively knew what to do with it, others had a bit of difficulty in understanding that they could hold it in different ways (with wings folded or unfolded, for example). How accustomed the subject grew to the interface seemed to affect how satisfied they were at the end of the experience. Certainly, an understanding of the interface seemed to make them more comfortable with the device than if it remained mysterious. Subsequent iterations of the device would do well to follow guideline #3 in making the interface more obvious and transparent.

Guideline #4 states that actions should have appropriate reactions and that the reactions should be varied in order to maintain interest. There was not clear evidence for this in the results. However, it was interesting during the course of study to notice that this strategy is used on *Mission: Space*. Each person has two buttons to press during the course of the ride, and when the button “needs” to be pressed, it flashes. When the button is pushed, the ride feels as if it reacts, and each button does something different so the participant gets to feel like they accomplished two important things (rather than the same thing twice). What if the participant doesn’t push the button? A voice comes into the ride audio, claiming a “system override”, and the computer supposedly completes the task that you failed to do. So far, though, out of the couple of handfuls of guests I have actively observed, none of them have failed to push a button. Somehow, the simple tasks they are given to accomplish (pushing buttons to make the rocket respond in ways that help complete the mission) are satisfying. The guest does not know exactly how the rocket will respond when the push the button, but they know that it will respond and that pushing the button will help their “crew” complete the mission. This seems to work effectively in the evolving story of that attraction, even though it is very simple.

In guideline #5, I stated that a device should have compelling sensory feedback. There is one caveat to this case: the compelling visuals, sounds, etc. should not distract from important moments in the ride environment. The participants did not seem to enjoy having their attention split. Aside from that, at least two participants indicated a desire for more compelling visuals and auditory (the capabilities of the lab being limited), and many of the participants had an immediate reaction when they received tactile feedback (the vibration of the toy), or a color change in the LED lights. In the future, it may be useful to study psychology and find out what sorts of feedback and at what intervals would be appropriate in order to help the guest feel “rewarded” for their interaction.

Guideline #6 states that a device should reiterate the central theme of an attraction. Indeed, several participants remarks were along narrative lines: they wanted a name for the bat, they wanted more back story, they wanted a clear connection to the ongoing story, and moments when the ride’s events and the devices responses intersected in concise and appropriate ways. In short, they wanted the device to have more than a tangential connection to the central theme: they wanted it to be somewhat integral to the story. This creates certain technological challenges, but it also hints at some exciting possibilities for how participants become connected with the story characters.

Finally, guideline #7 talks about the necessity of a concrete goal for the user and clear feedback. This may have been one of the stickiest parts of creating the device, and one where it needs some more experimentation and improvement. In a shooter ride, the guest has a concrete goal: to score as high as they can. This goal is easy for the guest to understand and concentrate on. In a story, what is the goal? Once we identify an appropriate goal (for example, Snow White needs to escape the Wicked Queen and find refuge), how do we help the guest emotionally invest in that goal and be able to have an active way of helping Snow White reach the dwarves’’ cottage? Goals for games are easy. Goals for story are less so. Feedback to the user has a similar predicament. If the feedback is extremely clear (for example, if the bat had an LED with the word “scared” printed by it, so that they knew the bat was scared if that light lit up), the object can begin to become more device-like and less relational. There is probably a subtle art to finding the affordances (the natural uses and qualities of an object that tell us immediately how to interact with it) that cue us into the inner psychology of an object (what it is trying to communicate, and why it acts like it does) without making it feel too much like a utilitarian tool or worse, something that insults the native intelligence of the user and causes interaction to feel superficial by making everything feel “dumbed down” with nothing to figure out or understand. Based on the reactions of the participants, the feedback needs to be more obvious, while still retaining the feeling that there is a psychology and intelligence to the character. Additionally, the goal needs to feel like it has a finite end that they can feel a victory in accomplishing (even if, for the story, some outcomes are better than others, there should be a sense that each interaction holds some success).

In the future, I would push the design to a level where the feedback is more opaque, the device’s response to specific ride events is clearly defined, and the device is not actively seeking attention during all parts of the ride. Even lights and some sound seemed distracting to participants in an undesirable way.

The findings of the study were very informative, and I feel like a second iteration of the device would be more effective by leaps and bounds if based on the user feedback received. I found it very useful to create a prototype and receive feedback, and the process has indeed seemed to confirm that devices should appear to be social, be peripheral to the attraction when the environment is complex, be intuitive to operate, react in a logical manner, be sensorily compelling in their feedback, be appropriately themed, and have a concrete goal that challenges the guest. I look forward to seeing how the future of entertainment develops.

APPENDIX A: STUDY QUESTIONNAIRE

Please make a mark in the box corresponding to your answer.

	Completely	Mostly	Somewhat	Only a little	Not at all
1. How much did you feel you were able to control events?					
2. How natural did your interactions with the ride seem?					
3. How much did you feel that the device contributed to your feelings of being immersed in the story world?					
4. How compelling was your sense of movement through space?					
5. How proficient with the device did you feel at the end of the experience?					
6. How completely were your senses engaged in this experience?					
7. Overall, how much did you focus on using the device instead of viewing the projected media?					
8. Were there moments that you felt completely focused on the screen environment?					
9. To what extent were you distracted by events occurring outside of the experimental media? If so, explain those events below.					
10. How much did you feel a part of the experience or connected to the characters?					
11. How much did you enjoy the experience overall.					

What did you perceive to be the story of this simulated theme park attraction?

Have you ridden this attraction at Epcot before?

Comments?

APPENDIX B: DEVICE PROGRAM

```
//music variables
int speakerPin = 13;
int length = 14; //the number of notes
//char happy2[] = "zbagabzgzbaga "; //a space represents a rest
//int beathappy2[]= {2, 4, 2, 4, 4, 5, 5, 5, 2, 5, 5, 5, 2, 2}; //worried
char notes2[] = "dbagabdgdbaga "; //a space represents a rest
int beats2[]= {10, 25, 6, 25, 15, 4, 10, 10, 8, 4, 18, 4, 6, 8}; //happy
char notes1[] = "czywdwyzczywd "; //a space represents a rest
int beats1[]= {20, 5, 5, 5, 20, 5, 5, 5, 20, 5, 5, 5, 20, 20}; //worried
int tempo = 300;
//photocell sensor
int potPin = 1;
int potValue = 0;
//leds
int led = 5;
int secondled = 6;
int thirdled = 9;
//emotions
int anxiety = 0;
int security = 200;
//vibrational motor
int vibratorPin = 10;
//flex sensors
int bentPin = 5;
int bentValue = 0;
int otherBentPin = 4;
int otherBentValue = 0;
//testing light
int checkLight = 12;
int counter = 0;

//Music code
void playTone(int tone, int duration) {
  for (long i = 0; i < duration * 100L; i += tone * 2) {
    digitalWrite(speakerPin, HIGH);
    delayMicroseconds(tone);
    digitalWrite(speakerPin, LOW);
    delayMicroseconds(tone);
  }
}
void playNote(char note, int duration) {
  char names[] = { 'c', 'z', 'y', 'w', 'd', 'e', 'f', 'g', 'a', 'b', 'C' };
  int tones[] = { 1915, 1865, 1815, 1760, 1700, 1519, 1432, 1275, 1136, 1014, 956 };
  //play the tone corresponding to the note name.
  for (int i = 0; i < 8; i++) {
```

```
    if (names[i] == note) {
      playTone(tones[i], duration);
    }
  }
  }

void setup() {
  Serial.begin(9600);
  pinMode(vibratorPin, OUTPUT);
  pinMode(speakerPin, OUTPUT);
}

void loop() {
  while(counter < 100){
    counter +=1;
  bentValue = analogRead(bentPin);
  otherBentValue = analogRead(otherBentPin);
  //Serial.println(bentValue);
  //Serial.println(otherBentValue);
  //potValue = analogRead(potPin);
  Serial.println(security);
  if(bentValue>605)
  {
  if(security < 200)
  {
  security +=5;
  //Note: if flex sensor is bent, and security is not maxed out, add to security.
  }
  else {}
  }
  else
  {
  if (security > 0)
  {
  security -=1;
  //Note: If flex sensor is unbent, and anxiety is not too low, subtract from security.
  }
  else {}
  }
  //Serial.println(security);
  if(otherBentValue>575)
  {
  if(security < 200)
  {
  security +=5;
```

```
//Note: if flex sensor is bent, and security is not maxed out, add to security.
}
else {}
}
else
{
if (security > 0)
{
security -=1;
//Note: If flex sensor is unbent, and anxiety is not too low, subtract from security.
}
else {}
}
potValue = analogRead(potPin);
//Serial.println(potValue);
if(potValue>1000)
{
if(anxiety > 0)
{
anxiety -=1;
//Note: if photocell finds a lot of light, and anxiety is greater than zero, subtract from anxiety.
}
else {}
//Note: if anxiety is at zero, leave it there.
}
else
{
if (anxiety < 200)
{
anxiety +=1;
//Note: If there's not that much light, and anxiety is not too high, increment anxiety.
}
else {}
}
//Note: the next section looks at the new value for anxiety and decides what lights to turn on,
and if the vibration motor should turn on.
if(anxiety > 100)
{
analogWrite(led, 0);
analogWrite(secondled, 100); //high anxiety is red light plus “shivering”
analogWrite(thirdled, 0);
digitalWrite(vibratorPin, HIGH);
}
else
{
```

```
analogWrite(led, potValue);
analogWrite(secondled, 0); //low anxiety is blue and green light and no “shivering”
analogWrite(thirdled, potValue);
digitalWrite(vibratorPin, LOW);
}
delay (100);
}
counter = 0;
if(security > 100){//if security is high
  if(anxiety < 100){//if anxiety is low
        for (int i=0; i < length; i++) {//happy song
    if (notes2[i] == ' ') {
      delay(beats2[i] * tempo);
      //rest
    } else {
      playNote(notes2[i], beats2[i] * tempo);
    }
    //pause between notes
    //delay(tempo / 2);
  }
  }
  else {//if anxiety is high
    analogWrite(led, 100);//colored light and pulsing
    analogWrite(secondled, 100);
    analogWrite(thirdled, 0);
    digitalWrite(vibratorPin, HIGH);
    delay (500);
  }
}
else {//if security is low
if(anxiety < 100){//if anxiety is low
    analogWrite(led, 100);//lights pulse colors
    analogWrite(secondled, 100);
    analogWrite(thirdled, 0);
    digitalWrite(vibratorPin, LOW);
    delay (500);
    analogWrite(led, 0);
    analogWrite(secondled, 100);
    analogWrite(thirdled, 100);
    digitalWrite(vibratorPin, LOW);
    delay (500);
    analogWrite(led, 100);
    analogWrite(secondled, 0);
    analogWrite(thirdled, 100);
    digitalWrite(vibratorPin, LOW);
```

```
    delay (500);
  }
  else{//if anxiety is high
  for (int i=0; i < length; i++) {//happy song
    if (notes1[i] == ' ') {
      delay(beats1[i] * tempo);
      //rest
    } else {
      playNote(notes1[i], beats1[i] * tempo);
    }
    //pause between notes
    //delay(tempo / 2);
   }
  }
}
}
```

//Note: basically, if the lights are down, anxiety will rise until the red light and vibrator motor come on.

//It won't go above 200. If the lights come back, anxiety will go down until the blue and green lights come back on.

APPENDIX C: VIDEO STILLS OF THE ATTRACTION

Figure 6: Pre-show video at ride's beginning

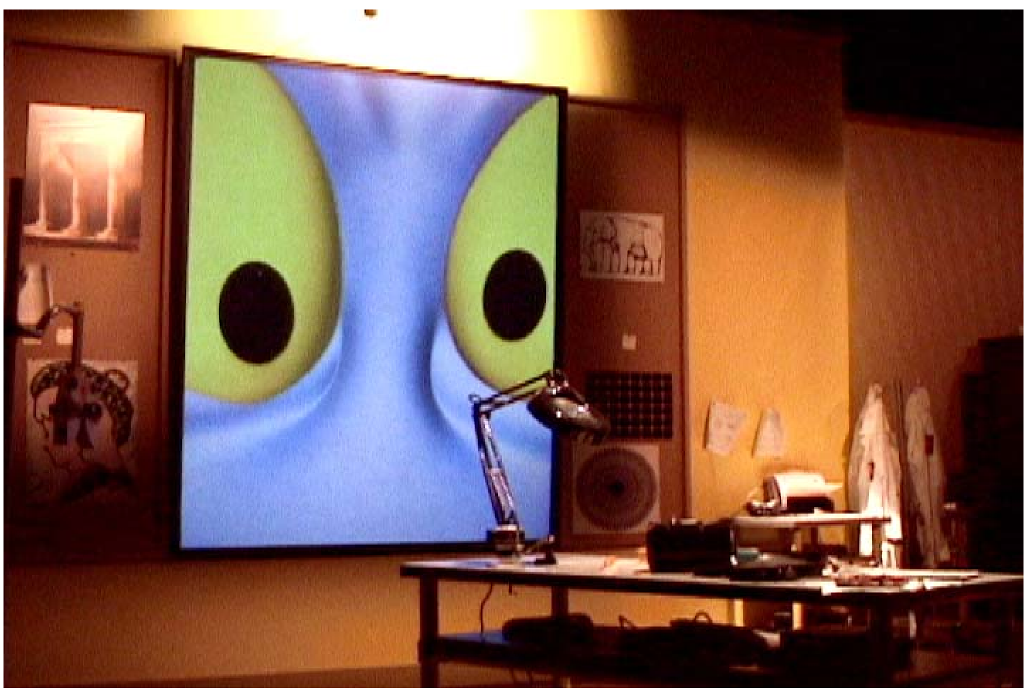

Figure 7: Figment teaches how sense of sight is related to imagination

Figure 8: Figment challenges our sense of smell

Figure 9: Figment’s upside-down house

Figure 10: Ride finale

These photos are stills from a video of that ride that I took in mid-October and showed to test subjects during the research phase.

APPENDIX D: IRB APPROVAL

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Initial Review and Approval

From : **UCF Institutional Review Board**
FWA00000351, Exp. 6/24/11, IRB00001138

To : **Kirsten G. Kischuk**

Date : **October 22, 2008**

IRB Number: **SBE-08-05813**

Study Title: **Assessing the Impact of Interactivity on Narrative for Theme Parks**

Dear Researcher:

Your research protocol noted above was approved by **expedited** review by the UCF IRB Chair on 10/21/2008. **The expiration date is 10/20/2009.** Your study was determined to be minimal risk for human subjects and expeditable per federal regulations, 45 CFR 46.110. The categories for which this study qualifies as expeditable research are as follows:

6. Collection of data from voice, video, digital, or image recordings made for research purposes.

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

The IRB has approved a **consent procedure which requires participants to sign consent forms.** Use of the approved, stamped consent document(s) is required. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Subjects or their representatives must receive a copy of the consent form(s).

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

To continue this research beyond the expiration date, a Continuing Review Form must be submitted 2 – 4 weeks prior to the expiration date. Advise the IRB if you receive a subpoena for the release of this information, or if a breach of confidentiality occurs. Also report any unanticipated problems or serious adverse events (within 5 working days). Do not make changes to the protocol methodology or consent form before obtaining IRB approval. Changes can be submitted for IRB review using the Addendum/Modification Request Form. An Addendum/Modification Request Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at http://iris.research.ucf.edu .

Failure to provide a continuing review report could lead to study suspension, a loss of funding and/or publication possibilities, or reporting of noncompliance to sponsors or funding agencies. The IRB maintains the authority under 45 CFR 46.110(e) to observe or have a third party observe the consent process and the research.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 10/22/2008 09:19:03 AM EDT

Joanne Muratori

IRB Coordinator

APPENDIX E: ADDITIONAL READING

If you would like to explore some of the concepts presented in this paper, these additional sources may be of interest to you. They were formative for me as I researched for this thesis, and there is a large amount of wonderful information and ideas here.

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