THE PERCEPTION OF TIME WAITING IN THEME PARK QUEUE LINES

By

Ellen C. Daniels

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Environmental Design - Master of Arts

2016

ABSTRACT

THE PERCEPTION OF TIME WAITING IN THEME PARK QUEUE LINES

By

Ellen C. Daniels

The purpose of this study is to investigate factors influencing people's perception of wait time in a theme park attraction queue (waiting line). Theme park designers can create a sense of suspended reality within the theme park to provide a positive perception and enhanced experience for their guests. This study presents an investigation to measure the suspended reality satisfaction in the design around the queue areas at Walt Disney World. This study attempts to determine if providing more suspended reality in the designed queue environment has an affect on guest perceptions of a shorter wait time than actual wait time. Using Friedman's statistical test, the results show modest significance (P Value less than or equal to 0.025) between the design efforts and shorter wait times perceived. However, there is a relationship found between time of day and guest perception using Kendall's statistical test that suggests that as the day goes on people perceive longer wait times (P Value less than or equal to 0.005). This paper provides proper insight for theme park operators to reduce the perceived time guests feel they waited as well as to improve customer satisfaction.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Importance of Research

For theme park patrons (guests), lines are typically the worst annoyance concerning the experience and worse than waiting is feeling like they waited longer than they actually did. Nonetheless, waiting in queues is inevitable at theme parks and in our society. Dr. Richard Larson, a professor at MIT, has studied the psychology of waiting in line for 30 years. His efforts on the topic have earned him the nickname of "Dr. Queue." Estimates calculate that an American spends at least two years in a queue line (Larson, 2011). This means 17,520 waking hours, or 730 days, or over 24 months during the average 80-year lifespan is spent waiting in queue systems. Larson, along with many other researchers (Larson, 2011; Baker & Cameron, 1996; Davis & Heineke, 1994; Erlang, 1917) study the theory of queuing which involves the mathematical study of waiting in lines which requires formulating models, developing operational formulas, and designing queue systems.

In 1917, a Danish telephone engineer named A.K. Erlang published "Solution of Some Problems in the Theory of Probabilities of Significance in Automatic Telephone Exchanges" and it contained the formulae for lost call and wait time. The benefit in using Erlang's formula in Queuing Theory is that the system can be separated into variables that explain how the queue system works and how it can be more efficient. For example, I observed at Walt Disney World where I was an employee in 2015 that these variables are carefully studied at amusement parks to create the most efficient process at each attraction so that there are signs at the beginning of the ride to inform guests of the estimated wait time. A computer can provide this estimation as it inputs the data of guests passing through a turnstile in a given amount of time with application of queuing equations (Hall, 1991). A queue engineer designs the line in order to keep the wait time as low as possible to provide the best service, which inevitably increases profits (Ragsdale, 2008).

While working at Disney World, I learned that amusement parks are businesses with the goal of creating the best experience for their guests so they are willing to return and spend more money. There are various line jumping passes offered to customers who choose to pay more money to spend less time in line and more time on rides; however, at Disney's theme parks, guests are given the opportunity to self-appoint reservations at no cost which allows them into the "FastPass+" line at which they skip the main queue for a shorter queue. Also at Disney World, I learned the FastPass program is a virtual queuing system created by the Walt Disney Company which creates a second queue at the attraction and can actually help lower the wait times for both lines to cycle more people through the attraction.

In recent years, studies have looked at amusement parks that design the lines of the attractions to be an engaging and useful time to patrons while waiting (Ledbetter, Mohamed-Ameen, Oglesby, & Boyce, 2013; Milman, 2013; Mine, 2012; Zuo, 2010). There are many systems and techniques that involve designing the lines and theme parks that successfully meet their guest's expectations by providing staged authenticity to suspend the guest's reality while waiting. This design technique of suspended reality can essentially extend the attraction experience into the queue environment for the guests to observe. Epcot is a great example of suspended reality design where guests at the Disney Park feel as if they have travelled around the world seeing the Eiffel Tower, Japanese gardens, and a Moroccan Minaret. Theme parks provide a sense of suspended reality by communicating through the process of theming their design with architecture, materials, lighting, sounds, smells, costumes, props, plants, and anything that would stage authenticity of the design intent. Suspended reality in design can be found throughout theme parks but this design approach is not always fully applied in the queuing systems for the park's attractions.

Modern theme parks such as Disney Parks and Universal Studios are facing the common problem of how to create and maintain suspended reality while their guests are waiting in line for park attractions. At any point, customers or employees can become impatient with each other about the inefficiency of the waiting system. When waits are inevitable, the goal should be to optimize the experience for customers and employees, thereby enhancing customer satisfaction and reducing employee stress and turnover (Norman, 2009). Because of the simple matter of timing and resources, visitors will always have to wait at their favorite theme parks, but, by proper design the waits do not have to be so boring anymore. There is sufficient information about suspended reality (Ledbetter, et al. 2013; Milman, 2013; Chytry, 2012) as well as knowledge about waiting in line (Albright & Winston, 2005; Norman, 2009; Larson, 1987; Maister, 1985) but there is a gap in the connections between suspended reality theory and queuing theory. This study is designed to fill this gap between design and queuing by interviewing a set of Walt Disney World visitors to discover how their experiences are affected by suspended reality while waiting. If suspended reality can create better experiences for the people dreading the wait, why not apply the design principles for staged reality directly in the line where people spend more time waiting than on the ride itself?

It is important to study this topic to better understand how people perceive time and their environment. Such studies provide insight to designers about the park guests' experience in order to design to their needs and make the space functional and enjoyable for them. This study is important for any person working towards the creation of theme park attractions such as park operators and managers, roller coaster engineers, theme park designers, Disney engineers and artists known as Imagineers, interior designers, landscape architects, and architects to better understand the patron's experience in the attraction. The study supports enhancing design at theme parks so people do not have a negative experience waiting in line, but rather find excitement about what is happening around them and there perceive the wait time as short. Encouraging attraction design to incorporate the queuing system with the overall themed experience, like at Disney Parks, will provide improved design and better theme parks. In fact, even Dr. "Queue" Larson gives Disney an A++ as the best managers of the psychology of queuing and stated that Walt Disney himself said the queuing experience should be the beginning of the entertainment (The Art & Science of Queuing, n.d.). Designing for the park customers' overall satisfaction of the park is the fundamental way to create a successful park and to earn returning customers.

Research Question

Based upon this formative experience and knowledge about Disney Parks I had an initial research question: Does the current design for suspending reality in queue lines affect a patron's estimation of their perceived wait time? Therefore, the following literature review describes what is known about the subject.

A Review of Relevant Literature

While there is much research on waiting in queues, there is not as much extensive research concerning queuing theory as applied to theme parks. There is, however, research on the topics of suspending reality, queuing theory and psychology, and customer satisfaction that will be included in this literature review. Even some literature relating to the theme park industry will also be reviewed.

Suspended Reality in Theme Parks

During my experiences at Disney World I learned that Disney's designers and engineers, commonly referred to as Imagineers, are the ones who create suspended reality within Disney Parks. This means creating a place that makes people forget their daily reality to experience something much better. I discovered that the Walt Disney Company refers to their park as a "fantasyland" where guests are able to partake in a new world outside of their own, e.g., experiencing life under the sea in the kingdom of The Little Mermaid or undergoing a riverboat cruise down the rivers South America. "Visiting Disneyland would be 'like a theatrical experience-in a word, a show'" (Chytry, 2012, p. 37).

A case study documented guests' experience of authenticity from the different country pavilions within the Epcot World Showcase was developed in 2013. This research found that theme parks provide unique settings to communicate and interact with their guests through the process of theming and stage authenticity, and, although audience familiarity is important to enhance the guest's experience, it is not always essential (Milman, 2013). In an article by Disney Imagineers, the concept of augmented reality (AR) was related to the guest experience (Mine, 2012). The article provides information that designers contribute narrative, music, art, and architecture combined with science, engineering, and advanced technology to take guests to the World of Yesterday, Tomorrow, and Fantasy (Mine, 2012). The AR technology is programed to create a shared experience that can be viewed instantaneous by multiple people. "Theme park environments and figures are increasingly interactive, reacting to the presence or actions of guests" (Mine, 2012 p. 39). The idea of AR technology and suspending reality primarily exists to enhance the engagement, pleasure, and satisfaction of the park guests.

Materials also play an essential role in the design process that result enhancing the physical environment to appease the customers. Materials are the basis for production in vehicle design, fashion design, architectural design, and in nature (Zuo, 2010). Understanding material's functional properties, engineering properties, relative cost, and sustainable features represent only some of the ingredients in material selection that contribute to the success of a well-designed product (Zuo, 2010). Zuo's Sensory Perception of Materials in Design (2010) focuses on the aspect of texture perception of materials and further explains in the study how this information is beneficial for designers to recognize. Imagineers or other amusement park designers must pay close attention to the detail of materials to satisfy their guests (Brieby, 2014). Brieby was interested in measuring aesthetic value and explored aesthetic dimensions in a nature-based tourism context by focusing on man-made environments. In her study, disciplines such as harmony, variation/contrast, scenery/viewing, genuineness, and art and architecture were measured finding that harmony and variation/contrast were the most influential dimensions on the tourists' experience (Breiby, 2014).

Walt Disney World was examined as a case study for queuing solutions and their implementation of design and management solutions to improve the waiting line process, "In particular, we examine Disney's emphasis on human capital within their theme parks, combined with traditional queuing theory to create more pleasurable waiting environments" (Chytry, 2012; Cope, Cope, Bass, Syrdal, 2011, p. 13). The application of queuing theory in the early stages of an attraction's design is the procedure for creating the most successfully themed and functional queues at theme parks (Cope, et al. 2011). Researchers, Cope, Cope, Bass, and Syral, believe Universal Studios, and Disney Parks in particular are the frontrunners in this application integration into their attractions based on the guests' general satisfaction with the queue design.

These studies are very important to begin the dialogue of suspended reality inside queues. Suspended reality research has yet to fully investigate the design elements within a queuing system that achieve customer satisfaction; however more research focusing on Queuing Theory and psychology will be examined to learn more about how suspended reality could possibly affect a person's wait experience and perceived service.

Queuing Theory and Psychology

Waiting in lines is part of everyday life. There are various queue models, or service systems, that people find themselves apart of any day. Typically, visitors want to avoid lines and operators want to make the most of their capital investments (Norman, 2009). These characteristics are the same no matter the location, e.g., grocery stores, gas stations, restaurants, airports, and amusement parks. Queuing Theory, began by A.K. Erlang, is the mathematical study of waiting in lines and is applied wherever an organization directly interacts with its customers as they confront the issue of a queue forming for service (Davis & Heineke, 1994).

Researchers study Queuing Theory to understand the system models and efficiency to make lines faster. According to the Albright and Winston (2005) there are five basic queue systems that define the queue: 1) number of waiting lines, 2) the number of servers, 3) the arrangement of the servers, 4) the arrival and service patterns, and 5) the service priority rules. A service system should be designed to provide successful, time efficient queuing at the business or place it will be utilized. The characteristics of the line can be plugged into formulae to make predictions about the queuing system, e.g., how long a wait will be and how many people can be served in a given amount of time.

"Every organization which directly interacts with its customer confronts the issue of queues" (Davis & Heineke, 1994, p. 21). Not only does the queue need to be a well-organized system, but also an environment that appeals to the customer. Research findings conclude that customers are more satisfied if their perception of the waiting is positive (Norman, 2008; Davis & Heineke, 1994; Larson, 1987). This knowledge leads into the realm of psychology by discovering what creates the perceived experience for the customers. Plenty of research (Albright & Winston, 2005; Erlang, 1917) occurs on the queue management and the ability to shorten wait times, but less is focused on the customers' experience and psychology.

In 1985, Maister wrote *The Psychology of Waiting Lines* to discuss the experiential elements of waiting lines. Maister defined "The First Law of Service" when considering the psychology of waiting. Is it as follows:

Satisfaction = Perception – Expectation

> “If you expect a certain level of service, and perceive the service reviewed to be higher, you are a satisfied client. If you perceive the same level as before, but expected higher, you are disappointed and, consequently, a dissatisfied client” (p. 2).

Applying this law, guest satisfaction at a theme park relies on the estimated wait time to be an accurate predication of the actual wait. If the attraction informs guests of a 60-minute wait time and they wait that amount or less, guests will feel satisfied; if they have to wait longer, they are dissatisfied. With his First Law of Service, Maister (1985) breaks down the psychology of waiting into eight principles to help companies understand how to satisfy customers:

1. Anxiety makes waits seem longer.
2. Preprocess waits feel longer than in-process waits.
3. Unoccupied time feels longer than occupied time.
4. Unexplained waits are longer than explained ones.
5. Waits with social injustices are longer than equitable ones.
6. Solo waiting feels longer than group waiting.
7. The more valuable the service, the longer people will wait.
8. Uncertain waits are longer than known, finite waits.

These principles emphasize the need for people to feel like they are occupied while waiting, whether that occupation is through communicating with others, through sensory stimulation, or preparing for the service such as familiarizing themselves with the menu before their table is ready. The interesting principle for theme parks is how people are willing to wait longer if the service is more valuable to them. It appears this psychological process is important for those 120+ minute waits at popular rides and attractions.

Norman's *The Psychology of Waiting Lines* (2008) updates the study of queue lines from the Maister's 1985 work. Norman's article discusses design principles for waiting lines that he believes provide the most effective queuing for successful business. The principles are similar to Maister's only Norman includes how the memory of an event is more important than the experience because "your future behavior will be controlled by your memories" (Norman, 2008, p. 9).

Norman's guidelines explain what keeps people pleased during their wait time. People want to know why and for what they are waiting for, feel that they are being served as well as possible, and see that social justice and fairness play a role in the queue system. An important idea that comes from these principles is that the memories of the queue experience are more important that the actual moments in the queue itself. The future behavior of the customers will be controlled by their memories (Norman, 2008). "Customer expectations, emotions and memories can be managed through the application of the appropriate design principles. Moreover, these principles do not only apply to how you treat your customers: They apply to employees just as much. Waits can be handled well: it's all a matter of design" (Norman, 2009, p. 28).

Ledbetter, Mohamed-Ameen, Oglesby, & Boyce (2013) also contributed their guidelines for successful theme park queuing models that reflect principles from Maister's and Norman's but put more emphasize on the significance of catering the guests with entertainment while waiting. These queue design guidelines encompass the benefits for implementing suspended reality in the queue system where guests will be engaged, interested, and comfortable as well as involved socially with surrounding patrons (Ledbetter, et al. 2013).

Not only should there be suspended reality in the design for the waiting area, but there should also be a system to serve social justice. Customers may become infuriated if they experience social injustice by feeling skipped or witnessing someone cut in first (Larson, 1987). In Larson's queue study he found, with one exception, each subject's anxious experience depended on the queuing environment and fair treatment. This shows that people's overall experience is based on a multitude of factors since multiple factors affect such an environment. Since Larson's study in 1987, more recent studies have attempted to break down the queue environment's components to further understand and satisfy customer's experience.

Customer Satisfaction

For a theme park to be competitive in the consumer market, it is essential the park owners and operators to work towards creating positive experiences for every guest (Rucks & Geissler, 2011; Bigné, Andreu, & Gnoth, 2005). Norman discusses how guests' discussion to return to the park is based on previous experience (2008). Amusement parks must make conscious efforts to provide happy memories so the guest is satisfied and will return with their business rather than visiting the competition (Thach and Axinn 1994). Keeping guests happy is a very difficult task, especially in this generation's culture of quick paced, instant gratification.

Today, people work more hours per week leaving fewer nonworking hours so they place great value on free time and the idea of "quality time" (Katz, Larson, & Larson, 1991). Thus, people's perception of waiting is generally a negative one and they want to be served immediately (Katz, et al. 1991). Even national culture plays an important role in queuing behavior as well. Results from a study on Western tourists versus Chinese tourists show an acceptable wait time for Western tourists is 21.3 minutes while Chinese tourists' acceptable wait was only 15.2 minutes (Heung, Tsang, & Cheng, 2009), as determined by their perception of waiting and their willingness to wait. Researchers have found that the main reason people are not willing to wait for theme park rides is because waiting reduces their leisure time or sense of vacation (Davis & Heineke, 1993; Katz, et al. 1991). If the guest values the ride higher than leisure, it is likely they are willing to wait for it.

A field experiment was done in the Netherlands to show how consumers evaluate waiting time. In the experiment, waiting times were filled in different ways: music, queuing information, and information about expected waiting time (Antonidea, Verhoef & van Aalst 2002). The experiment involved 236 customers who waited over the phone where they were exposed to the "filler" variables. All of the filler attempts showed a decrease in over-estimation but the most significant decreases were correlated with provided queue information and duration knowledge, which proved to be the most effective variable to satisfy the customers in phone queues.

The theme park experience: An analysis of pleasure, arousal and satisfaction by Bigné, Andreu and Gnoth (2005) provides one model of customer satisfaction. Customer satisfaction results in willingness to pay more and more customer loyalty. Factors that influence satisfaction were defined as positive arousal, pleasure, and positive disconfirmation (Bigné, et al. 2005). When guests are aroused and pleased, they will pay more and have loyalty to the company (Bigné, et al. 2005, p. 841). The challenge to constantly please customers never fades, particularly in the theme park industry.

In attempts to please guests better regarding the inconvenience of waiting for rides, Walt Disney World introduced the FastPass program in 1999 that provides time specified reservations for certain park attractions. David Fisher (1999), a spokesman for Disney Imagineering noted, “Waiting in line is one of the biggest complaints we are confronted with.” FassPass spreads out the crowd throughout that day rather than too many arriving at once. It was a free line-jumping program available to any guest. This eliminates the inequitable treatment at Disney Parks of “The rich get to go first, and that is not fair” perception that line-jumping creates for average customers (Norman, 2009). It is in everyone’s benefit, park employees included, that crowding is managed and dispersed to avoid major conflicts throughout the day, which subsequently creates satisfied customers.

Crowding leads to major displeasure among amusement park visitors and is also a problem that prevents people from visiting in the first place (Brown, Kappes, & Marks, 2013). The Journal of Travel Research published *Mitigating Theme Park Crowding with Incentives and Information on Mobile Devices* that measured visitors’ receptivity to a wide variety of informational, experimental, and commercial incentives (Brown, et al. 2013). The article investigates ways to use geo-tracked mobile devices to mitigate the crowding problem, both to increase visitor satisfaction and their intent to visit and revisit (Brown, et al. 2013). An updated FassPass+ program, introduced in 2013, connects guests with their reservations to a mobile device app called My Disney Experience, which also provides current wait times for all Walt Disney World attractions. The app is a tool that provides information to guests instantly and at their convenience that allows them to plan their day at the park accordingly.

With all of the attempts to spread out visitor crowding, speed up queues, and elevate service, there are many circumstances when the actual wait time cannot be changed, at least not enough to be noticed by customers. When a wait is inevitable, the queue strategy gears towards the perceived wait and making people *feel* like they waited less by the use of environmental characteristics. These characteristics include varying levels of lighting, temperature, music, color, furnishings, and entertainment, as well as changing the spatial layout of the queue (Baker & Cameron, 1996). An example of how changing the environment affected wait time perception is in Whiting and Donthu's (2009) research that investigated which elements influence the gap between the telephone caller's perception of the wait versus how long they were actually on hold. Survey results display that music increases the likelihood of estimation error, unless callers can choose the music they want to hear. Findings also show waiting information reduces estimation error, and that callers with urgent issues have more estimation error and that they overestimate more. Lastly the data found that females perceive a longer wait time than what the actual time was and they tend to overestimate more than males. This knowledge helps understand the callers and measuring items that are important to them and determine what call managers can do to reduce the gap of estimation error and primarily, satisfy customers (Whiting & Donthu 2009).

Earlier research from 1997 discovers the impact of waiting time guarantees on customers' waiting experiences and perspectives. In this experiment, some participants were given their wait time guarantee while others were left to wait without any indication of wait duration. The participants waiting with a time guarantee showed higher satisfaction on the point scale both in-queue and post-queue (Kumar, Kalwani, Dada, 1997). However, the researchers note that giving customers a time guarantee suggests that the time guarantee service is accurate. If the time estimated is wrong or greatly exceeds the customer's actual wait time, the customer may end up being more dissatisfied than would have been without knowing the expected wait duration in the first place (Kumar, et al. 1997). Therefore, it seems significant to provide an accurate time guarantee to result in satisfied customers.

The results of a customer satisfaction study at Hong Kong Disneyland Resort show that guests' predispositions about the service and company were found to predict their service experience evaluation (Dong & Sui, 2013). So creating a servicescape (designed/constructed attractive queue setting) for people is significant each time they are exposed to it. By observing customers for several hours, noting what services occurred, how long they spent at the different attractions, body language reacting to service experiences, and what interactions he or she had with employees, Trischler & Zehrer (2012) used a qualitative approach to discover guests experiences with service. Findings show the importance of interactions with animated characters, a consistency in theme through the whole journey, rest areas that are protected from the atmosphere, and the design of and entertainment within queuing areas were all beneficial to a guest's positive experience. The study covered the overall experience of service with regards to waiting and queue lines, but does not show what that design or entertainment has to be or should accomplish to satisfy the guests.

Ten years of customer satisfaction tracking data was collected at a major American theme park to identify significant factors influencing customers' evaluation of the overall experience (Rucks & Geissler, 2011). Researchers found that to feel satisfied, in general, people were interested in having quality park food, price/value, cleanliness of the park, and variety in experiences (Rucks & Geissler 2011). The researchers report that customer's expectation of the experience is a factor that will influence the customer's evaluation. Rucks and Geissler strongly suggest that theme parks consider 'framing' the expectations guests bring to the park. "Providing and promoting numerous benefits and an overall experience that outweigh associated costs is the key to gaining a sustainable competitive advantage, particularly in cross-category competition" (Rucks & Geissler 2011, p. 137). This study, along with Kumar, Kalwani, and Dada's (1997) study in wait time guarantees, provides a principle to under-promise and over-deliver. Increasing the estimated wait time-to-guarantee gives the park a few more minutes for error and potentially delivers a shorter wait time, resulting in happy guests and satisfied customers.

Summary

The literature presented previous research in the areas of Queue Theory and customer satisfaction. Research on queuing models and the design of queue environments have molded real-life queuing experiences for customers. Literature on the psychological processes customers experience while waiting was presented to explain customer's emotional and social responses. Studies have been developing the concept of satisfaction by examining different situations to determine the factors that influence the customer's evaluation of their experience and what can be done to improve those responses. The theme park industry has been growing for many years and has become a huge vacation phenomenon, honeymoon getaway, family tradition, and hub for thrill and entertainment. Examining the reasons people experience theme parks the way they do is crucial information for owners, operators, and managers of these parks.

This study will gather information about guest's theme park wait experience to discover if suspended reality can sufficiently lower their perceived wait time as a shorter duration than in reality. The experiment hypothesizes that when guests are exposed to environments with less suspended reality they will perceive a longer wait than the guaranteed wait time. Additionally, when guests are in queues with higher amounts of suspended reality in the design, they perceive a shorter durations.

METHODS

Determining Theme Park for Study

In order to study the wait experience of theme park guests, an experiment is created to gather the guests' perception of their wait time in a popular theme park. In 2014, Themed Entertainment Association published their global attractions attendance report presenting the most popular amusement parks, which is represented in Table 1. A park with higher attendance will generally have more people waiting in lines, which creates longer wait times. In this report attendance population ranks Disney's Magic Kingdom the most popular park ranked by attendance, therefore, the experiment will be conducted within this theme park to test the perceptions in long queues where guests have enough time to experience the wait and queue environment.

Table 1: Most Popular Amusement Parks published by Themed Entertainment Association in 2014

Rank	Park & Location	2014 attendance
1	Disney's Magic Kingdom Lake Buena Vista, FL	19,332,000
2	Tokyo Disneyland Tokyo, Japan	17,300,000
3	Disneyland Anaheim, CA	16,769,000
4	Tokyo Disney Sea Tokyo, Japan	14,100,000
5	Universal Studios Japan Osaka, Japan	11,800,000
6	Disney's Epcot Lake Buena Vista, FL	11,454,000
7	Disney's Animal Kingdom Lake Buena Vista, FL	10,402,000
8	Disney's Hollywood Studios Lake Buena Vista, FL	10,312,000
9	Disneyland Park Marne-La-Vallee, France	9,940,000
10	Disneyland's CA Adventure Anaheim, CA	8,769,000
11	Universal Studios Orlando, FL	8,263,000
12	Universal's Islands of Adventure Orlando, FL	8,141,000

Determining Queue Lines for Study

Within the Magic Kingdom, people wait in various queues: entrance admission, food service, character meet and greets, and the rides and attractions. The longest wait times generally occur in queues for rides and attractions. These queue environments also tend to have more substance to them when with regard to design elements such as architecture, materials, and other theming components. Therefore, this experiment will collect data from the popular attractions with the longest wait times. The longer duration of waits will give guests time to experience the design elements as well as determine their attitude and perception of the wait. To determine the queues with the longest wait times, all 40 attractions in the Magic Kingdom were observed and recorded the wait times during 80 days of typical park operations. During the observation period, the attraction Pirates of the Caribbean was closed for maintenance and remodeling, therefore it is not presented in this study. The queues that were available and continuously showed the longest waits were chosen as the highest trending attractions that would guarantee guests to wait in the queue. This determines 12 attractions' queues that have wait times guests typically wait over 30 minutes.

Ranking Queue Lines by Suspended Reality Level

The twelve queues are studied to measure the amount of suspended reality used in design to complement the theme and narrative of each attraction. This establishes if the queue has "good show" or "bad show," which are terms used by the Walt Disney Company to explain presentation in their theme parks. A point system for the design elements will be used to determine which queues have the greatest amount of suspended reality versus the least amount of suspended reality in their queue environments. An inventory of design elements and features inside each queue is recorded in full detail to accurately rate the queues' design as well as to produce the main design categories that make up a theme park attraction queue line. The design categories measured in this study include:

1. Architecture
2. Surrounding materials (ceiling, ground, walls, etc.)
3. Lighting
4. Audible sounds
5. Atmosphere (temperature, mist, etc.)

6. Props (theming and scenery)
7. Effective form and shape of line
8. Plant materials
9. Interactive elements
10. Technology
11. Key visual elements (displays, film, monumental land marks etc.)
12. Views (sight lines and landscapes)

Each design category is worth up to a value of five (5) for "excellent" when it is best presented, or has "good show;" zero (0) for "very poor" if it is not accurately applied in the queue design, or is "bad show." The twelve categories are worth five points each, for a possible Suspended Reality Score (SR-score) of 60 points. This scoring system has not been validated as a SR-score and is created for this experiment in order to determine a ranking for the amount of suspended reality within queue lines. The highest scores will determine the greatest suspended reality and the lowest scores as queues most lacking in this concept. Tables presenting the ranking of SR-scores in each queue line are included in Appendix A of this study.

A high SR-score example is the queue for Seven Dwarf Mine Train because it is an amazing, interactive queue line. The concrete floor is imbedded with pieces of gems the seven dwarfs mine for, large barrels filled with gems for guests to spin around, lights that project animated characters onto the ceiling of a cave, hands-on water features, and there is even a touch screen table to play a game matching gems to the right shape and color (Figure 1). This queue line also includes Snow White's cottage in the woods providing the complete scenery of the first full-length animated film (Figure 2). These types of elements are ranked 5 out of 5 for surrounding materials, lighting, plant materials, interactive elements, technology and key visual elements and rated 52/60 points.

Figure 1: Seven Dwarf Mine Train’s Interactive touch-screen game

Figure 2: Snow White’s cottage

The lowest SR-score is 19/60 for Tomorrowland Speedway's queue line shown in Figure 3. This queue ranked "very poor" in props, interactive elements, technology, and key visual elements. Unlike, Seven Dwarf Mine Train, there was an absence of interactive features to distract guests from the reality of waiting. Though Tomorrowland Speedway used colors, sounds, and views well, it lacked in use of new-age technology and displays to add to the car race theming. The queue line is more about progressing in a single-line until boarding a vehicle than about the experience of the story within the queue system.

Figure 3: Tomorrowland Speedway's queue system

When design elements work together, suspended reality is created thereby inspiring guests to believe that they are immersed within the attraction, story concept, and overall design purpose. The queues that accomplish this with best SR-scores are Seven Dwarf Mine Train, Peter Pan's Flight, Under the Sea ~ Journey of the Little Mermaid, and Haunted Mansion. The attractions that include a minimal amount of suspended reality and subsequently have low SR-scores are Jungle Cruise, Space Mountain, It's a Small World, and Tomorrowland Speedway. These rides were the only attractions to have scored three or more zeros on the design element study; therefore, they were all missing more than one element in the line that causes it to lack suspended reality and present “bad show” to Magic Kingdom guests. Along with the knowledge of the design and SR-scores, this experiment will collect responses from park guests to determine if there is a correlation between their perceived experience and the suspended reality.

Procedure

To collect data on the guests’ queuing experience for this study, subjects will be Magic Kingdom guests who have waited in one of the twelve selected queues. As subjects exit the attraction they are asked if they experienced a wait that felt longer, shorter, or the same amount of time that was provided by Disney as the estimated wait time at the entrance of the queue. Estimated wait time is important information to the guests because research shows people feel less anxious and more satisfied in line if they have are aware of the guaranteed wait time (Kumar, et al. 1997, Ledbetter, et al. 2013).

This experiment was conducted on one single day to maintain consistent variables as much as possible at the Magic Kingdom in Lake Buena Vista, Florida. The study took place from 10:45am to 7:35pm on November 20th, 2015, with a high of 68°F. As subjects exited the attraction, they were interviewed with the one question about their perceived wait time versus the provided wait time estimate. Subjects eligible for this experiment are guests who waited in the queue without utilizing their FastPass+ privileges and who ranged from eighteen years old to about seventy years old, of any background, ethnicity, or race. Once ten subjects have responded from a queue and the times are recorded, the next queue is tested until all 12 queues are completed resulting with 120 subjects’ responses.

Hypotheses

The first hypothesis for this experiment states that when guests are queue in lines with higher SR-scores they will perceive a shorter wait time and feel more satisfied with their experience. Furthermore, when guests are exposed to design environments with low SR-scores, they will perceive a longer wait than their actual wait time. The second hypothesis predicts that as the day goes on, people will feel more agitated and report longer perceived wait times.

Equation Formulae

Friedman's Two-way Analysis of Variance of Ranks determines if the suspended reality in the queue affects guest's estimation of the time they waited. This statistical process was developed by Milton Friedman to detect differences in distributions of the quantitative variables.

$$F = [12/(N*k*k+1)] * \Sigma R^2 - [3 * N* (k+1)]$$

(Equation 1)

The equation used to find where differences are located in the data is the multiple-comparison equation associated with Friedman's Two-way Analysis of Variance of Ranks.

$$| R_j - R_j^2 | \geq z \sqrt{bk\,(k+1)/6}$$

(Equation 2)

Kendall's Coefficient of Concordance is the statistical process used to determine if the time of day affects the guest's estimate of the time they waited.

$$W = \frac{12\ \Sigma^n_{i=1} (R^2_i) - 3m^2n(n+1)^2}{m^2n(n^2 - 1)}$$

(Equation 3)

In the case that any ties occur in the data, this adjustment in the equation will make up for the ties in the rankings to find differences.

$$W = \frac{\Sigma^{n}_{i=1}(R^{2}_{i}) - 3m^{2}n(n+1)^{2}}{m^{2}n(n^{2}-1) - m\,\Sigma^{m}_{j=1}(T_{j})}$$

(Equation 4)

RESULTS

Friedman's Two-way Analysis of Variance of Ranks

To analyze guest response data with the variable of suspended reality, the statistical process Friedman's Two-Way Analysis of Variance of Ranks is used with equation 1 (Daniel, 1978). The rankings that are analyzed in this test are the suspended reality; SR-scores (Rank 1) and the response scores (Rank 2) from the experiment participants represented in Table 2.

Table 2: Twelve queue lines ranked according to SR and participants responses

Rank 1	1	2	3	4	5	6	7	8	9	10	11	12
Rank 2	7.5	5.5	3	3	7.5	10	3	12	9	11	5.5	1
Total	8.5	7.5	6	7	12.5	16	10	20	18	21	16.5	13
Total Squared	72.25	56.25	36	49	156.25	256	100	400	324	441	272.25	169

Using equation 1, *N* is the number of ranks, SR-score and response score (2), and *k* is the number of conditions, in this study, queues (12). By calculating in these variables with the sum of the squared values of 2,332, the chi-square, or *F*, is equal to 23.6923. To account for the occurrences in the rankings where there are ties, a sum of the ties is calculated. This sum equals the tie value cubed and subtracted by such value; therefore, $(2^3-2) + (2^3-2) + (3^3-3) = 36$. This is plugged into $1-(36/((N*k)*((k^2)-1)))$ to equal 0.9895, which is divided into the previous *F* value of 23.6923 for the updated chi-square value of 23.9434.

There is a table provided to find critical values in Friedman's test that correlate to the 23.9434 chi-square. If the chi-square is greater or equal to the determined critical value, the data is is significant. This critical value for this process is 21.92 with a P value of 0.025. The chi-square 23.9434 value is greater than 21.92 but not by a significant difference. This means the results are not very strong. The variable of suspended reality is affects the data with differences, but barely.

Multiple Comparisons

However, to find exactly where these differences are located in the data, equation 2 is applied with the Friedman test (Daniel, 1978). When comparing all possible differences between pairs of samples, our error rate is α, and when the number of blocks is large then *Rj* and *Rj'* are significantly different in equation 2. Using this formula, *Rj* and *Rj'* are the *j*th and *j'*th treatment rank totals, $\alpha = 0.05$, and z is a value corresponding from the table of critical values. First the calculation solves for the z-score by using 0.05/(2*12*(12-1)) to equal 0.000189, and subtract that from 0.5 becomes 0.4998 for a z-score of 3.56. Using this variable in the formula provides a value of 25.67 which is not lesser or equal to the α 0.05.

This process is repeated with a second α of 0.10 to compare to the first α. Solve for the z-score by using 0.10/(2*12*(12-1)) to equal 0.000038, and divide that by 0.1 becomes 0.00038 for a z-score of 3.37. Using this variable in the formula provides a value of 24.3 which, again, is not lesser or equal to the α 0.10. These results are compared to the normal curve areas on Figure 4.

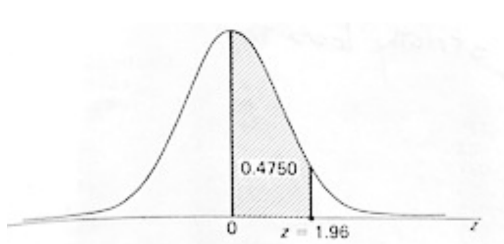

Figure 4: Normal standard deviation curve

The multiple-comparisons process determines that there is not enough evidence to state that these queues are different based on suspended reality. The results are so small they are in the third set of the standard deviation on the normal curve graph.

Kendall's Coefficient of Concordance

Due to the low correlation found between suspended reality and wait time perceptions of the guests this study will run the data with the recorded time responses. To determine if the responses correlate with the time of day, Kendall's *W*, also referred to as Kendall's Coefficient of Concordance, is assessed within the data (Daniel, 1978). This statistical process will show if the time of day is a significant factor in the results of theme park guests' perception of time while waiting. In this procedure, Kendall's *W* will determine the extent to which two sets of rankings of 11 queue lines agree or disagree where Rank 1 is the ranking of response scores and Rank 2 is the ranking of the time of day as the experiment occurred represented in Table 3. The sum totals are calculated for each queue and then the totals are squared.

Table 3: Eleven queue lines ranked according to participants' perception of wait time

Rank 1	1	3	3	3	5.5	5.5	7	8	9	10	11
Rank 2	1	2	3	4	5	6	7	8	9	10	11
Total	2	5	6	7	10.5	11.5	14	16	18	20	22
Total Squared	4	25	36	49	110.25	132.25	196	256	324	400	484

The computationally most convenient form of the test statistic is equation where the sum of totals squared is 2,016.5, *m* is the number of sets of rankings (2), *n* is the number of queues that are ranked (11) and *Rj* is the sum of the ranks assigned to the *j*th queue which simplifies to 24,198/4,340 and defines W as 5.5756. This W value provides a chi-square value of 109.99 however there needs to be an adjustment for when the rankings tie.

Kendall's Coefficient of Concordance Tie Adjustments

There are three queues that tie for 3rd, therefore, 3 will be cubed and subtracted by 3, which equals 24. There are two rankings that tie at 5.5, therefore, 2 is also cubed and subtracted by 2, to equal 6. Equation 4 is used to test for the ties, where W value is used again to find the new chi-square: $m(n\text{-}1)W = 111.5115$. The degrees of freedom is n-1 (11-1), therefore, equal to 10. The table provided for critical values for Kendall's test gives us a value of 25.118. To be significant data, the final result should be a number greater than 25.118, and since 111.51 is much greater than 25.118, the ranks are in concordance at a P of less than or equal to 0.005. Because the data shows a significant result, it is determined that the time of day is crucial to how a guest will experience the time waiting at a theme park attraction.

DISCUSSION

In this study, the way people perceived time during the day and waiting in a queue system was investigated. The results show that there is no significant outcome for the variable of suspended reality among the responses. However, it does show that there is significance in the variable for time of day in which the response was given.

<u>Suspended Reality Score and Guest Responses</u>

The data results showed that there was no consistency in the study's data on the responses as they related to suspending reality in the design of the queue environment. Figure 5 shows the responses in relation to the SR-scores that defined the queue's design.

Length Of Wait Times Perceived Within Suspended Reality

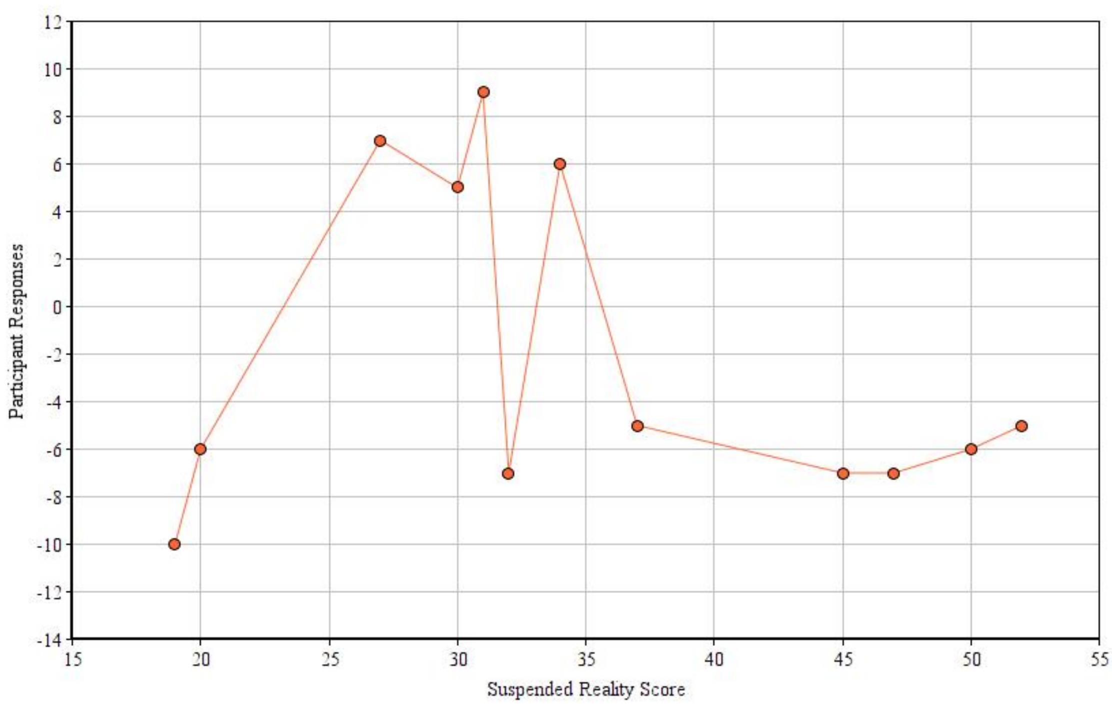

Figure 5: Results of responses in relation to suspended reality design in the queue

The relationship of SR-score to the responses shows very little consistency or pattern on the graph. The hypothesis was that the higher SR-scores would result in a lower Response Score, however, this graphic shows that the Response Score is more randomly rated among the SR-scores. This indicates that there is no strongly significant finding in this study to support the suspended reality design efforts to generate perceptions of shorter wait times.

Without highly significant results or predictable outcomes it is difficult to determine why guests responded the way they do to suspended reality. One reason suspended reality is not as influential on the guests' response in the experiment might be because the participants were over the age of eighteen. The procedures for human subject researching allowed this experiment to interview adults and not children. Many of the suspended reality efforts of games and play equipment are more effective for children who become engaged with these kinds of distractions therefore the results may be reflecting how susceptible adults are to the suspended reality.

To further investigate how people are responding to the wait duration, the types of suspended reality provided should be measured further. Whether there are captivating puzzles to solve, games to play, video provided, or live music, people are going to respond positively or negatively to various types of distractions. This study used twelve design categories to rate the queue line's level suspended reality but there are more solutions that could provide more understanding about which design elements or features are essential in successfully suspending a guest's reality of waiting.

Another reason for the response guests had towards the suspended reality has to do with the time of day they waited. The responses during the time of day are considerably predictable therefore guests waiting in the morning may experience the suspended reality efforts differently than those waiting in the afternoon. When guests are more excitable and there is less crowding they may be able to perceive the suspended reality better than when they are fatigued or fed up with crowds. Kaplan & Kaplan (1989) suggest that over time fatigue sets in as one experiences daily life and they go on to further say that one must have a restorative time to reset the fatigue level to zero. This insight may lead to a further line of research and understanding of queue lines. Therefore, conducting a study investigating queues at various times of day in a rotating cycle would give more insight into understanding suspended reality during the day.

Time Of Day and Guest Responses

The results did show a significant relationship between the time of day and the responses recorded from the theme park. The original hypothesis for this experiment was that the response score would continually increase later in the day. The results support that hypothesis somewhat but also show a drop in response scores in the evening that was not expected shown in Figure 6.

Length of Wait Times Perceived Throughout Experiment

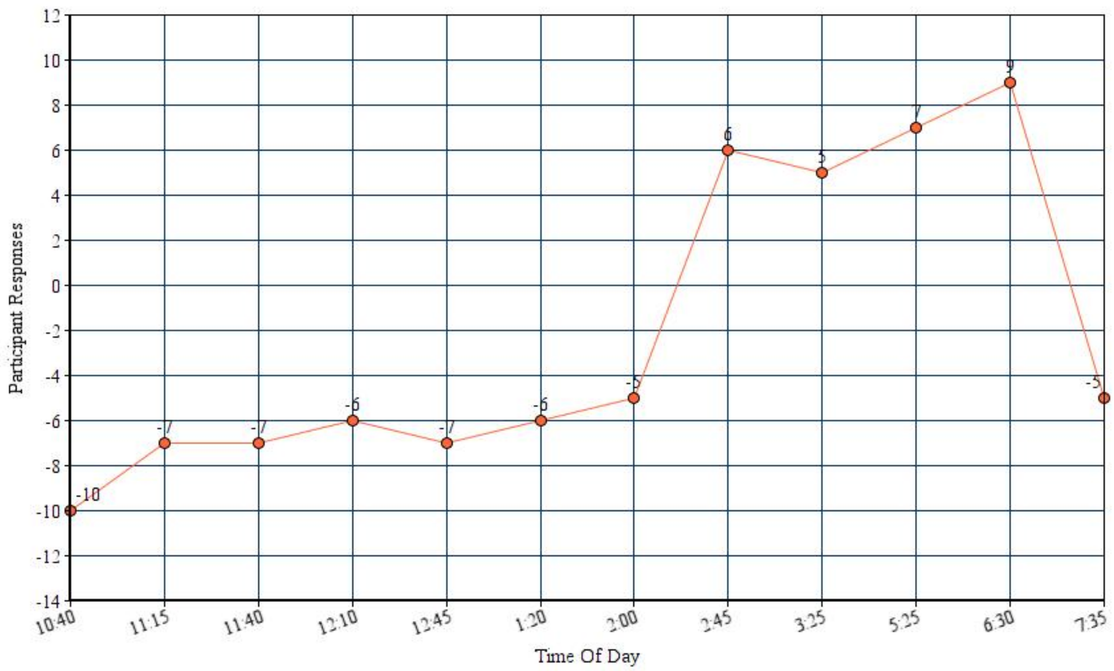

Figure 6: Results of responses in relation to the time of day spent in the queue

As the day went on, response scores went up until they eventually hit a tipping point and came back down. People responded with a perception of shorter wait times in the morning until approximately 2:30pm, followed by responses of longer wait times between 2:30pm and 7:00pm. The true tipping point is approximately 6:30pm because after this time there are recordings of shorter wait perception again at 7:35pm. This means that people perceive time differently throughout the day. This provides knowledge to better predict how people will respond to waiting in the morning, afternoon, and evening.

One reason for the results showing more agitated and fatigued afternoons can be explained by how people respond during their time at a theme park. In the morning, people are refreshed and thrilled to be at the Disney Park finding they have more patience because nothing has got them down yet. As the morning passes, lines get longer crowding increases, and guests become more eager and impatient while standing in queue lines. There is more opportunity for agitated feelings as the day goes on and circumstances have them upset, fatigued, hungry, bored in line, or anything else they are experiencing. However, after guests have eaten dinner, there is a change in their moods with the excitement of what the evening will bring them: less crowding, shorter lines, a lit-up nighttime parade, and fireworks at the famous Cinderella Castle. This study finds that the experiences guests have throughout the day affect how they perceived time waiting.

Recommendations

Not only do the results show how people will react to queue lines throughout the day, but the results give theme parks the necessary knowledge to better accommodate their guests in queue lines. With this information, theme parks could try different things that would appeal to the guests during their agitated hours (around 2:30-7:00pm). For example, Disney Parks could provide more line-jumping FastPasses during this these hours to give guests shorter waits. In addition, Disney could have a big mid-day performance or show that would draw in thousands of guests thereby resulting in shorter waits at the attractions. In order to get audience numbers that large, the show has to be amazingly entertaining, but, most of all there needs to be an incentive for the guest, e.g., the show could be at the castle and cast members could go around handing out food vouchers, coupons for the stores, FastPasses for that evening, or any other appropriate incentive. The evening FassPasses would encourage guests to stay at the park longer, therefore providing more moneymaking opportunities for Disney.

There could also be larger efforts to provide suspended reality to their guests by various accommodations such as beverages, snacks, and cooler air on those hot Florida days between the hours of 2:30-7:00pm. Additionally, Disney Parks could take advantage of the almost universal smart phone technology by implementing cell phone applications. Applications could be designed specifically to entertain guests who are waiting in queues and could include games, puzzles, trivia, etc. This has good potential to improve the perception of wait times and customer satisfaction. Since the Walt Disney Company is already using an application that provides guests with information about the attraction wait times, it would seem that adding new pages of queue entertainment to this app would be achievable.

There are a lot of plans that theme parks can implement to improve a guest's experience, but, ultimately, every person perceives the world differently. More research on the psychology during waiting will have to develop to continue gaining knowledge for improving our theme park queue lines. Even finding more about how different cultures, ages, and genders experience time can change how queue systems are approached.

Wait Time Perception by Gender

In Whiting & Donthu's study (2009), data showed that females tended to perceive longer waits then male participants; therefore, this study reviewed the data it gathered from male and female responses to determine if Whiting & Donthu's findings are also true for waiting theme park guests. This study's results differ from the results of Whiting & Donthu's results because this study found more men who display a longer perception of time shown on the chi-square table in Table 4.

Overestimations by Gender

Table 4: Results of perceived wait time by gender

	Male	Female
Perceived Time Longer	20	17
Perceived Time Accurately	9	11
Perceived Time Shorter	31	32

One reason some men may be more likely to over estimate their wait time could be due to the way men perceive Walt Disney World as a theme park. It is possible some men view the Magic Kingdom is the world's most expensive playground designed for children. It may be more stressful for these men to wait in line for something they do not view as exciting as women and children do. Another reason for the gender gap in wait time estimation could be that men are more interested in thrilling rides such as those at Six Flags, Busch Gardens, or Cedar Point that would make them less interested in the Disney attractions furthermore less interested in waiting around to ride it. Future research would need to take place to discover the amount of interest a guest has for a particular attraction. However, it is important to realize the results shown on the chi-square table between male and female are so close that it is not a very significant factor in this experiment.

Limitations & Future Studies

While this study was initiated as a response to the limitations of designing large theme park queues, it invariably has limitations of its own. Some of these limitations result from the design of this specific study, while others are a characteristic of the nature of the model. All of which present future opportunities for studies to discover further information.

One limitation this study has is the range at which responses were taken. It is evident that with more queues evaluated and tested there would be more responses recorded. However, using queues with wait times consistently longer than thirty minutes throughout the day presented the study with only twelve suitable queue lines. To expand this variable, future research could introduce other theme parks needed to provide valuable queues such as Disney's Hollywood Studios, Epcot, and Disney's Animal Kingdom, which would present further suitable participants.

Another limitation this study faced was the limited information about the guests in line. Perception has much to do with a person's psyche, present circumstances and past experiences of a person. To define their reasoning for their response in this study simply based on the variables of suspended reality and time of day does not fully equate. Including children participants in this study and documenting the ages of all participants would also benefit a future study. There are myriad other factors that may have an affect on a response such as the person or party they are with, the level of thrill the attraction presents them, their need to eat or go to the restroom, as well as their infatuation with the particular attraction. These are some examples of variables this study did not cover but may, or may not, show significance if assessed in following studies. This study's success creates many prospects for future work.

CONCLUSION

This study assessed and documented the effects of the environment on people's perception of time while waiting in theme park queue line. The suspended reality levels in each queue design was measured and evaluated to see how it affected park guest's wait experience. The results of 120 responses throughout the 12 queue lines showed no significant relation between the suspended reality level and the participants' perception of time; however, the results supported the significance between the time of day and perception of how long they waited.

This outcome is very important to theme parks but is also useful for any company or facility where customers spend time waiting for service. It shows there are possibilities to enhance the waiting experience for customers during the hours of less-optimistic perceptions. For example, medical facilities could strategically distribute their appointments before 2:30pm; grocery stores could have more open registers during these hours, and the Department of Motor Vehicles could provide more staff during the afternoon to decrease their customer's wait times.

This study is influential for future theme park guests and other waiting customers to receive better service because, ultimately, it is beneficial to the companies if they have happier, well-satisfied customers so those customers are more likely to continue their business with them. The Walt Disney Company makes extremely strong efforts to please their customers in every way, which is a huge factor for their uniqueness and success. Disney represents a great example of why investing significant effort and capital results in tremendous return on that investment. This study, along with the many other studies covered in the literature review, will provide knowledge and strategies to company leaders who want to confront the issue of queuing.

The fields connected to queue theory are growing and receiving more attention than in the past decade. This may be in response to the shift in our immediate, no patience society where more things are provided for customers instantly. It is pressing that we discover how to make queue systems more efficient and effective for the customer, especially if they are willing to wait in lines as long as those at Walt Disney World.

APPENDICES

Appendix A

Design Categories in the Magic Kingdom's Attraction Queue Lines:

Table 5: Big Thunder Mountain Railroad SR-score

BIG THUNDER MOUNTAIN RAILROAD	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	**2**	3	4	5
Surrounding Materials	0	1	2	3	**4**	5
Lighting	0	1	2	**3**	4	5
Audible Sounds	0	1	2	3	**4**	5
Atmosphere	0	**1**	2	3	4	5
Props	0	1	2	3	**4**	5
Form/Shape	0	1	**2**	3	4	5
Plant Materials	0	**1**	2	3	4	5
Interactive Elements	0	1	2	**3**	4	5
Technology	0	1	**2**	3	4	5
Key Visual Elements	0	1	**2**	3	4	5
Views	0	1	2	3	**4**	5

SR-SCORE TOTAL: 32/60

Table 6: Buzz Lightyear's Space Ranger Spin SR-score

BUZZ LIGHTYEAR'S SPACE RANGER SPIN	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	**2**	3	4	5
Surrounding Materials	0	1	2	3	**4**	5
Lighting	0	1	2	**3**	4	5
Audible Sounds	0	1	**2**	3	4	5
Atmosphere	0	1	2	3	**4**	5
Props	0	1	2	3	**4**	5
Form/Shape	0	1	**2**	3	4	5
Plant Materials	**0**	1	2	3	4	5
Interactive Elements	**0**	1	2	3	4	5
Technology	0	1	2	3	**4**	5
Key Visual Elements	0	1	2	3	4	**5**
Views	0	**1**	2	3	4	5

SR-SCORE TOTAL: 31/60

Table 7: Haunted Mansion SR-score

HAUNTED MANSION	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	3	4	**5**
Surrounding Materials	0	1	2	**3**	4	5
Lighting	0	1	2	**3**	4	5
Audible Sounds	0	1	2	3	**4**	5
Atmosphere	0	1	2	3	**4**	5
Props	0	1	**2**	3	4	5
Form/Shape	0	1	2	3	**4**	5
Plant Materials	0	1	2	**3**	4	5
Interactive Elements	0	1	2	3	4	**5**
Technology	0	1	2	3	**4**	5
Key Visual Elements	0	1	2	3	4	**5**
Views	0	1	2	**3**	4	5

SR-SCORE TOTAL: 45/60

Table 8: It's A Small World SR-score

IT'S A SMALL WORLD	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	**2**	3	4	5
Surrounding Materials	0	**1**	2	3	4	5
Lighting	0	1	2	3	**4**	5
Audible Sounds	0	1	2	**3**	4	5
Atmosphere	0	1	**2**	3	4	5
Props	0	1	**2**	3	4	5
Form/Shape	0	1	**2**	3	4	5
Plant Materials	**0**	1	2	3	4	5
Interactive Elements	**0**	1	2	3	4	5
Technology	**0**	1	2	3	4	5
Key Visual Elements	0	1	**2**	3	4	5
Views	0	1	**2**	3	4	5

SR-SCORE TOTAL: 20/60

Table 9: Jungle Cruise SR-score

JUNGLE CRUISE	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	**3**	4	5
Surrounding Materials	0	1	2	3	**4**	5
Lighting	0	1	2	3	4	**5**
Audible Sounds	0	1	2	**3**	4	5
Atmosphere	**0**	1	2	3	4	5
Props	0	1	2	3	**4**	5
Form/Shape	0	1	2	3	**4**	5
Plant Materials	0	1	2	3	**4**	5
Interactive Elements	**0**	1	2	3	4	5
Technology	0	**1**	2	3	4	5
Key Visual Elements	**0**	1	2	3	4	5
Views	0	1	**2**	3	4	5

SR-SCORE TOTAL: 30/60

Table 10: The Many Adventures of Winnie The Pooh SR-score

THE MANY ADVENTURES OF WINNIE THE POOH	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	**3**	4	5
Surrounding Materials	0	1	2	3	**4**	5
Lighting	0	1	2	3	4	**5**
Audible Sounds	0	1	2	**3**	4	5
Atmosphere	0	1	**2**	3	4	5
Props	0	1	2	**3**	4	5
Form/Shape	0	1	**2**	3	4	5
Plant Materials	0	1	2	3	4	**5**
Interactive Elements	0	1	2	3	4	**5**
Technology	0	1	2	3	**4**	5
Key Visual Elements	0	**1**	2	3	4	5
Views	**0**	1	2	3	4	5

SR-SCORE TOTAL: 37/60

Table 11: Peter Pan's Flight SR-score

PETER PAN'S FLIGHT	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	3	**4**	5
Surrounding Materials	0	1	2	3	4	**5**
Lighting	0	1	2	3	4	**5**
Audible Sounds	0	1	2	**3**	4	5
Atmosphere	0	1	2	3	4	**5**
Props	0	1	2	3	4	**5**
Form/Shape	0	1	2	3	**4**	5
Plant Materials	0	**1**	2	3	4	5
Interactive Elements	0	1	2	3	**4**	5
Technology	0	1	2	3	4	**5**
Key Visual Elements	0	1	2	3	4	**5**
Views	0	1	2	3	**4**	5

SR-SCORE TOTAL: 50/60

Table 12: Seven Dwarfs Mine Train SR-score

SEVEN DWARFS MINE TRAIN	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	3	**4**	5
Surrounding Materials	0	1	2	3	4	**5**
Lighting	0	1	2	3	4	**5**
Audible Sounds	0	1	2	3	**4**	5
Atmosphere	0	1	2	3	**4**	5
Props	0	1	2	3	**4**	5
Form/Shape	0	1	2	**3**	4	5
Plant Materials	0	1	2	3	4	**5**
Interactive Elements	0	1	2	3	4	**5**
Technology	0	1	2	3	4	**5**
Key Visual Elements	0	1	2	3	4	**5**
Views	0	1	2	**3**	4	5

SR-SCORE TOTAL: 52/60

Table 13: Space Mountain SR-score

SPACE MOUNTAIN	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	**3**	4	5
Surrounding Materials	0	**1**	2	3	4	5
Lighting	0	1	2	3	4	**5**
Audible Sounds	0	1	2	**3**	4	5
Atmosphere	0	1	2	3	**4**	5
Props	0	1	**2**	3	4	5
Form/Shape	0	**1**	2	3	4	5
Plant Materials	**0**	1	2	3	4	5
Interactive Elements	0	1	2	3	4	**5**
Technology	0	1	2	**3**	4	5
Key Visual Elements	**0**	1	2	3	4	5
Views	**0**	1	2	3	4	5

SR-SCORE TOTAL: 27/60

Table 14: Splash Mountain SR-score

SPLASH MOUNTAIN	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	3	4	**5**
Surrounding Materials	0	1	2	**3**	4	5
Lighting	0	1	2	3	4	**5**
Audible Sounds	0	1	**2**	3	4	5
Atmosphere	0	1	2	3	4	**5**
Props	0	1	2	3	**4**	5
Form/Shape	0	1	**2**	3	4	5
Plant Materials	0	1	2	**3**	4	5
Interactive Elements	**0**	1	2	3	4	5
Technology	**0**	1	2	3	4	5
Key Visual Elements	0	1	**2**	3	4	5
Views	0	1	2	**3**	4	5

SR-SCORE TOTAL: 34/60

Table 15: Tomorrowland Speedway SR-score

TOMORROWLAND SPEEDWAY	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	**2**	3	4	5
Surrounding Materials	0	**1**	2	3	4	5
Lighting	0	1	2	**3**	4	5
Audible Sounds	0	1	2	3	**4**	5
Atmosphere	0	**1**	2	3	4	5
Props	**0**	1	2	3	4	5
Form/Shape	0	1	**2**	3	4	5
Plant Materials	0	**1**	2	3	4	5
Interactive Elements	**0**	1	2	3	4	5
Technology	**0**	1	2	3	4	5
Key Visual Elements	**0**	1	2	3	4	5
Views	0	1	2	3	4	**5**

SR-SCORE TOTAL: 19/60

Table 16: Under The Sea ~ Journey Of The Little Mermaid SR-score

UNDER THE SEA ~ JOURNEY OF THE LITTLE MERMAID	Very Poor	Poor	Fair	Good	Very Good	Excellent
Architecture	0	1	2	3	4	**5**
Surrounding Materials	0	1	2	3	4	**5**
Lighting	0	1	2	3	4	**5**
Audible Sounds	0	1	2	3	**4**	5
Atmosphere	0	1	2	3	**4**	5
Props	0	1	2	3	**4**	5
Form/Shape	0	1	2	3	4	**5**
Plant Materials	0	1	2	3	4	**5**
Interactive Elements	0	**1**	2	3	4	5
Technology	0	1	2	**3**	4	5
Key Visual Elements	0	1	2	3	**4**	5
Views	0	1	**2**	3	4	5

SR-SCORE TOTAL: 47/60

Appendix B

Field Study Data

Table 17: Field Study Data

Subject	M/F	Queue Line	SR-Score	Wait Time (min)	Response	R-Score	Time Recorded
1	M	Seven Dwarf Mine	52	80	0		
2	M	Seven Dwarf Mine	52	80	-1		
3	F	Seven Dwarf Mine	52	80	-1		
4	M	Seven Dwarf Mine	52	80	-1		
5	M	Seven Dwarf Mine	52	80	1		
6	F	Seven Dwarf Mine	52	80	-1		
7	M	Seven Dwarf Mine	52	80	-1		
8	F	Seven Dwarf Mine	52	80	1		
9	F	Seven Dwarf Mine	52	80	-1		
10	F	Seven Dwarf Mine	52	80	-1	**-5**	2:00pm
11	F	Peter Pan's Flight	50	110	-1		
12	F	Peter Pan's Flight	50	110	0		
13	M	Peter Pan's Flight	50	110	1		
14	M	Peter Pan's Flight	50	110	-1		
15	M	Peter Pan's Flight	50	110	-1		
16	F	Peter Pan's Flight	50	110	-1		
17	F	Peter Pan's Flight	50	110	-1		
18	M	Peter Pan's Flight	50	110	-1		
19	M	Peter Pan's Flight	50	110	0		
20	F	Peter Pan's Flight	50	110	-1	**-6**	12: 10pm
21	M	Under the Sea	47	25	-1		
22	M	Under the Sea	47	25	-1		
23	F	Under the Sea	47	25	-1		
24	M	Under the Sea	47	25	-1		
25	F	Under the Sea	47	25	0		
26	M	Under the Sea	47	25	-1		
27	F	Under the Sea	47	25	-1		
28	F	Under the Sea	47	25	-1		
29	M	Under the Sea	47	25	0		
30	F	Under the Sea	47	25	0	**-7**	11:15am
31	F	Haunted Mansion	45	45	-1		
32	M	Haunted Mansion	45	45	1		
33	M	Haunted Mansion	45	45	-1		
34	F	Haunted Mansion	45	45	-1		
35	M	Haunted Mansion	45	45	-1		
36	F	Haunted Mansion	45	45	0		
37	M	Haunted Mansion	45	45	-1		

Table 17 (cont'd)

38	M	Haunted Mansion	45	45	-1		
39	M	Haunted Mansion	45	45	-1		
40	F	Haunted Mansion	45	45	-1	**-7**	11:40am
41	F	Winnie Pooh	37	40	0		
42	M	Winnie Pooh	37	40	1		
43	F	Winnie Pooh	37	40	-1		
44	M	Winnie Pooh	37	40	-1		
45	F	Winnie Pooh	37	40	0		
46	F	Winnie Pooh	37	40	-1		
47	M	Winnie Pooh	37	40	-1		
48	F	Winnie Pooh	37	40	-1		
49	M	Winnie Pooh	37	40	-1		
50	M	Winnie Pooh	37	40	0	**-5**	7:35pm
51	M	Splash Mountain	34	60	1		
52	M	Splash Mountain	34	60	1		
53	F	Splash Mountain	34	60	1		
54	M	Splash Mountain	34	60	0		
55	F	Splash Mountain	34	60	-1		
56	F	Splash Mountain	34	60	1		
57	F	Splash Mountain	34	60	0		
58	M	Splash Mountain	34	60	1		
59	F	Splash Mountain	34	60	1		
60	F	Splash Mountain	34	60	1	**6**	2:45pm
61	F	Big Thunder	32	25	-1		
62	M	Big Thunder	32	25	-1		
63	F	Big Thunder	32	25	-1		
64	M	Big Thunder	32	25	-1		
65	M	Big Thunder	32	25	-1		
66	M	Big Thunder	32	25	-1		
67	F	Big Thunder	32	25	0		
68	M	Big Thunder	32	25	-1		
69	M	Big Thunder	32	25	0		
70	F	Big Thunder	32	25	0	**-7**	12:45pm
71	M	Buzz Lightyear	31	40	1		
72	M	Buzz Lightyear	31	40	1		
73	F	Buzz Lightyear	31	40	1		
74	M	Buzz Lightyear	31	40	1		
75	M	Buzz Lightyear	31	40	0		

Table 17 (cont'd)

76	M	Buzz Lightyear	31	40	1		
77	F	Buzz Lightyear	31	40	1		
78	M	Buzz Lightyear	31	40	1		
79	F	Buzz Lightyear	31	40	1		
80	F	Buzz Lightyear	31	40	1	**9**	6:30pm
81	M	Jungle Cruise	30	40	-1		
82	F	Jungle Cruise	30	40	1		
83	F	Jungle Cruise	30	40	-1		
84	M	Jungle Cruise	30	40	1		
85	F	Jungle Cruise	30	40	1		
86	F	Jungle Cruise	30	40	1		
87	F	Jungle Cruise	30	40	0		
88	M	Jungle Cruise	30	40	1		
89	F	Jungle Cruise	30	40	1		
90	M	Jungle Cruise	30	40	1	**5**	3:25PM
91	F	Space Mountain	27	55	1		
92	F	Space Mountain	27	55	1		
93	M	Space Mountain	27	55	1		
94	M	Space Mountain	27	55	1		
95	M	Space Mountain	27	55	1		
96	F	Space Mountain	27	55	1		
97	M	Space Mountain	27	55	1		
98	M	Space Mountain	27	55	0		
99	F	Space Mountain	27	55	-1		
100	F	Space Mountain	27	55	1	**7**	5:25pm
101	M	Small World	20	30	-1		
102	F	Small World	20	30	-1		
103	M	Small World	20	30	-1		
104	F	Small World	20	30	-1		
105	F	Small World	20	30	0		
106	F	Small World	20	30	-1		
107	M	Small World	20	30	1		
108	M	Small World	20	30	0		
109	F	Small World	20	30	-1		
110	F	Small World	20	30	-1	**-6**	1:20pm
111	M	Tmrrw Spdway	19	30	-1		
112	M	Tmrrw Spdway	19	30	-1		
113	F	Tmrrw Spdway	19	30	-1		
114	F	Tmrrw Spdway	19	30	-1		

Table 17 (cont'd)

115	M	Tmrrw Spdway	19	30	-1		
116	F	Tmrrw Spdway	19	30	-1		
117	M	Tmrrw Spdway	19	30	-1		
118	F	Tmrrw Spdway	19	30	-1		
119	F	Tmrrw Spdway	19	30	-1		
120	M	Tmrrw Spdway	19	30	-1	**-10**	10:40am

REFERENCES

REFERENCES

Albright, S. C., & Winston, W. L. (2005). Spreadsheet modeling and applications: essentials of practical management science. South-Western Pub.

Antonides, G., Verhoef, P. C., & van Aalst, M. (2002). Consumer perception and evaluation of waiting time: A field experiment. Journal of Consumer Psychology, 12(3), 193-202. doi:http://dx.doi.org/10.1207/S15327663JCP1203_02

The Art & Science of Queuing: A Guide to Queue Management [PDF]. (n.d.). Lavi Industries.

Baker, J., & Cameron, M. (1996). The effects of the service environment on affect and consumer perception of waiting time: An integrative review and research propositions. Journal of the Academy of Marketing Science, 24(4), 338-349.

Bigné, J. E., Andreu, L., & Gnoth, J. (2005). The theme park experience: An analysis of pleasure, arousal and satisfaction. Tourism Management, 26(6), 833-844.

Breiby, M. A. (2014). Exploring aesthetic dimensions in a nature-based tourism context. *Journal of Vacation Marketing*, *20*(2), 163-173.

Brown, A., & Kappes, J. (2013). Mitigating theme park crowding with incentives and information on mobile devices. Journal of Travel Research, 52(4), 426-436. doi:10.1177/0047287512475216

Chytry, J. (2012). Disney's design. Boom, 2(1), 33. doi:10.1525/boom.2012.2.1.33

Cope, R. F., Robert F Cope III, Bass, A. N., & Syrdal, H. A. (2011). Innovative knowledge management at disney: Human capital and queuing solutions for services. Journal of Service Science, 4(1), 13.

Daniel, W. W. (1978). Applied nonparametric statistics. Boston: Houghton Mifflin.

Davis, M. M., & Heineke, J. (1994). Understanding the roles of the customer and the operation for better queue management. International Journal of Operations & Production Management, 14(5), 21-34. doi:10.1108/01443579410056777

Dong, P., & Siu, N. Y. (2013). Servicescape elements, customer predispositions and service experience: The case of theme park visitors. Tourism Management, 36, 541-551.

Hall, Randolph W. *Queueing Methods for Services and Manufacturing*. Englewood Cliffs, N.J.: Prentice-Hall, 1991

Heung, V. C. S., Tsang, N., & Cheng, M. (2009). Queuing behavior in theme parks: A comparison between chinese and western tourists. Journal of China Tourism Research, 5(1), 41-51. doi:10.1080/19388160802711394

Kaplan, R. Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge University Press.

Katz, K. L., Larson, B. M., & Larson, R. C. (1991). Prescription for the waiting-in-line blues: Entertain, enlighten, and engage. MIT Sloan Management Review, 32(2), 44.

Kumar, P., Kalwani, M. U., & Dada, M. (1997). The impact of waiting time guarantees on customers' waiting experiences. Marketing science, 16(4), 295-314.

Larson, R. (1987). Perspectives On Queues: Social Justice and the Psychology of Queuing.

Larson, R. (2011). New Research on the Theory of Waiting Lines (Queues), Including the Psychology of Queuing. Lecture presented at INFORMS. Retrieved from https://www.youtube.com/watch?v=_CBD2z51u5c

Ledbetter, J. L., Mohamed-Ameen, A., Oglesby, J. M., & Boyce, M. W. (2013). Your Wait Time From This Point Will Be... Practices for Designing Amusement Park Queues. Ergonomics in Design: The Quarterly of Human Factors Applications, 21(2), 22-28.

Maister. D. (1985). “The Psychology of Waiting Lines.” in The Service Encounter. eds. Czepiel. J. et al. Lexington. MA

Milman, A. (2013). Guests' perception of staged authenticity in a theme park: An example from disney's epcot's world showcase. Tourism Review, 68(4), 71-88. doi:10.1108/TR-09-2013-0052

Mine, M. R., van Baar, J., Grundhofer, A., Rose, D., & Yang, B. (2012). Projection-based augmented reality in disney theme parks. Computer, 45(7), 32-40. doi:10.1109/MC.2012.154

Norman, D. A. (2008). The psychology of waiting lines. Excerpt of.

Norman, D. A. (2009). Designing waits that work. MIT Sloan Management Review, 50(4), 23-28.

Ragsdale, Cliff T. *Spreadsheet Modeling & Decision Analysis*, Fifth Edition. Stamford, Conn.: Thomson, 2008

Rucks, C. T., & Geissler, G. L. (2011). The overall theme park experience: A visitor satisfaction tracking study. Journal of Vacation Marketing, 17(2), 127-138. doi:10.1177/1356766710392480

Thach, S. V., & Axinn, C. N. (1994). Patron assessments of amusement park attributes. Journal of Travel Research, 32(3), 51-60.

Trischler, J., & Zehrer, A. (2012). Service design: Suggesting a qualitative multistep approach for analyzing and examining theme park experiences. Journal of Vacation Marketing, 18(1), 57-71.

Whiting, A., & Donthu, N. (2009). Closing the gap between perceived and actual waiting times in a call center: results from a field study. Journal of Services Marketing, 23(5), 279-288.

Zuo, H. (2010). Sensory Perception of Materials in Design. Journal of Wuhan University of Technology, 1, 002.