Spatial Schema Transfers to Similar Place: A Case of Disney Theme Parks

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SPATIAL SCHEMA TRANSFERS TO SIMILAR PLACE: A CASE OF DISNEY THEME PARKS

by

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A thesis submitted in partial fulfillment of the requirements for the Honors in the Major Program in Psychology in the College of Sciences and the Burnett Honors College at the University of Central Florida

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Thesis Chair: Valerie Sims, Ph. D.
Abstract:
The intent of this thesis is to explore whether an existing spatial schema assists with learning a similar environment to the existing schema. Spatially experienced and non-experienced participants of Magic Kingdom Park learned a similar park, Disneyland Park, using a virtual environment. Participants learned the virtual environment either passively or actively. Spatially experienced participants outperformed the non-experienced participants on survey and route knowledge assessments, despite of the training method used in the virtual environment. The results suggest that the existing schema for a similar place transfers to the new environment regardless of passive or active training.
Dedication:

For
Adam Whitmer
Mom & Dad
Stephanie & Yury
Kirk
Acknowledgements:

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INTRODUCTION

The objective of this study is to determine whether an existing spatial schema assists with learning a similar environment to the existing schema. For instance, it is becoming more and more common to see cookie-cutter housing developments and shopping plazas due to urban sprawl. Specifically, this research explores whether expertise, or spatial experience, influences the ability to learn a similar place that one already has experience with. This study explores whether having spatial experience allows one to incorporate new spatial information into an existing spatial schema or whether two mental maps are created when learning a new, but familiar looking place. Furthermore, this study investigates whether memory interference occurs as a result of changing an experienced person’s schema of their familiar place. This was accomplished in the current study by having spatially experienced and non-experienced participants of a Disney theme park learn a similar park using a virtual environment.

Schema Theory

The origin of the word “schema” (pl. schemata) has a diverse history. It can be defined as an organized framework of something that has been learned through experience. Several theorists tried to explain how humans organize information learned through experience. Immanuel Kant (1781) proposed that there are “innate structures” that create conceptual categories that help us understand the world around us. Bartlett (1932) continued the work of schema theory in experimental and cognitive psychology by further demonstrating that memories are reconstructed and influenced by past, organized experiences. Piaget (1952) was a child psychologist who reintroduced the term “schema” to psychology by explaining that children
create schemata by learning how to interact with their environment through real-world knowledge and practice, or assimilation and accommodation. In other words, children develop an expectation of what things are or how they behave from past experience through trial and error. Assimilation is used when we incorporate new information to our existing schema and accommodation occurs when new information changes an existing schema.

More recently, Neisser (1976) has defined a schema as a tool to organize knowledge from mental patterns of cognition. In addition, Neisser explains that a schema directly influences how a person perceives the world because of how the information is stored, and subsequently, what patterns of thought are activated from past experiences. Our environment is a crucial piece in perception and it provides cues that drive behavior (Norman & Shallice, 1986). Graesser and Nakamura (1982) argue that schemata exist in memory to guide and assist in information processing of the environment. This current research is specifically concerned with how learned information about space is organized in a schema.

**Spatial Schemata**

Schema theories propose that prior experience will influence the ability to learn and retrieve the new information. From previously mentioned work on schemata, a spatial schema can be described as a framework of expectations for a place built upon prior experiences. Minsky (1975) theorized already existing schemata in memory help facilitate perception of similar looking places. The existence of an individual’s spatial knowledge is structured in an organized way due to past experience and the overall outcome is a spatial schema. It has been shown that schemata of a place influence individual’s performance on memory tasks (Anderson & Pichert,
It can be argued that spatial memory and schemata develop simultaneously and mutually strengthen each other.

It is hypothesized that memory of a place becomes a spatial schema because it is an integrated, organized structure of a mental model and a similar looking place will impair or disorient that existing schema. Brewer and Treyens (1981) demonstrated that spatial schemata have a significant impact on memory of places. Participants were taken into a fake graduate student’s office that had typical items and non-typical items inside. Later, participants were asked to recall items from the room and items that were better recalled were ones that fit the “office schema.” Richardson and Ball (2009) have made the argument that spatial information is represented by a mental model (or, in this case a spatial schema). The objective of this current study is to explore whether an existing spatial schema would cause traversal errors in a similar place.

Spatial Cognition & Expertise

The way we incorporate and think about spatial information that we acquire from everyday tasks is deeply rooted in memory. People gain spatial knowledge over time through experience with spatial layouts and it influences the ability to think in spatial terms (Montello, 1998). In other words, spatial cognition is the study of acquired knowledge regarding spatial components of the objects and places in the world. There are some people who have acquired more spatial knowledge about a particular location than others. Often, this is simply because one person may have more experience with the location due to the amount of time spent there or the frequency of visits to that specific location. Woollett and Maguire (2010) demonstrated that spatial experts have a difficult time incorporating new spatial information into their existing
spatial memory of a place. In that study, London taxi drivers were considered expert navigators and had two tasks in the experiment. They were instructed (1) to learn an unfamiliar city and (2) to add a new area of London into their existing spatial knowledge. London taxi drivers were better at learning route and survey knowledge of new town compared to control group, but significantly worse at learning the layout of the new area that had to be integrated into existing knowledge of London. The participants in the study by Woollett and Maguire (2010) learned an artificial section of city, however, and this might not have real-world applicability of spatial schema confusion. The present study will explore how spatial experts learn new spatial information that is similar to their existing spatial information in order to determine whether there are two representations of a similar place, or one representation that is augmented.

A spatial expert is someone who has a great deal of experience navigating a specific location and his or her accompanying spatial memory in comparison to someone with any relative spatial knowledge. It is hypothesized that someone with spatial experience will be impaired by his or her existing spatial knowledge and schema when learning a similar environment, compared to someone with little to no spatial knowledge.

The goal of this current research is to examine two aspects acquired from spatial cognition: route and survey knowledge. Wickens (1992) defines route knowledge as being able to get from one place to another by connecting landmarks and survey knowledge as a reconstructed “mental map” of the area. It has been demonstrated that learning survey knowledge is more advantageous for non-experts (Golledge, Dougherty, & Bell, 1995) and that it reduces errors in estimation of positions of locations, but those who learn route knowledge give more accurate estimations of distances (Thorndyke & Hayes-Roth, 1982). However, it has been
suggested that the perspective from which the knowledge was acquired affects how that spatial knowledge is stored in memory (Evans & Pezdeck 1980; Sholl, 1987; Thorndyke, 1981). These studies suggest that different types of memories are formed depending on how the way spatial knowledge was learned. Specifically, Thorndyke (1981) resolves that people gain different kinds of spatial knowledge like images of objects, names or distances or places, procedural memory, mental maps, and those different types are ideal for varying tasks.

Training in Virtual Environments

Previous research has explored the efficiency of various methods of spatial learning. The goal of this present research is to explore active and passive learning in virtual environments. Passive learning in a virtual environment can be described as being guided by an avatar with no control over the action taken or traversal in the environment. Active learning in a virtual environment can be described as having free roam or control over the environment and the actions taken. Active learning of spatial tasks has been shown to be better for memory recall than passive learning (Farrel, Arnold, Pettifier, Adams, Graham, MacManamon, 2003; James, Humphrey, Vilis, Corrie, Baddour, & Goodale, 2002). In other words, active learning has been shown to be a more effective means of learning due to the ability to control or personalize the spatial experience. Particularly, in the study by James et al. (2002), participants studied virtual, 3D objects through active exploration or passive observation through a virtual environment. The participants were later asked to indicate whether they had or had not studied particular objects that appeared on a screen. This study demonstrated that active control in virtual environment assisted in more effective object recognition.
These modes of learning have been shown to have real-world applicability. Learning a real place through a virtual environment has been shown to be an effective manner of learning route knowledge and can transfer to real-world traversal (Witmer, Bailey, Knerr, & Parsons, 1996). In the study by Witmer et al. (1996), participants learned route directions and landmark photographs and then practiced their spatial knowledge in either the actual building, a virtual environment of the building, or verbal directions and photographs of the building. Route knowledge assessments showed that practice in the real building was the best training, followed by the virtual environment and verbal directions, respectively. This study demonstrated that practice in the virtual environment provided great training of the real environment, when the real environment is inaccessible, due to the real-world complexity that can be displayed in a virtual environment. That is to say, the influence of virtual environments on spatial knowledge of a real place has been found to facilitate transfer into real-world conditions (Peruch, Vercher, & Gauthier, 1995; Waller, Hunt, & Knapp, 1998). In the study by Waller et al. (1998) participants learned a real environment (a maze created with black curtains in a rectangular grid with stuffed animals as landmarks and numbers on cardboard to distinguish paths) by exploring the real environment for one minute, studying a map for one minute, using a desktop virtual environment for two minutes, using a head-mounted virtual environment display for two minutes, using a head-mounted virtual environment display for five minutes, or they were in the control condition with no exposure to the environment. The results of that study demonstrated that brief exposure to the virtual environment training did not surpass map training, but more time with the virtual environment exceeded real-world training in routing the real-world environment. Waller et al. (1998) did not include a longer amount of time in the real environment during the training, as it
may have surpassed the virtual environment training altogether. However, they argue that virtual environments are often used for training when the real environment is unavailable, costly, or risky, and thus longer exposure to the virtual environment can create effective spatial representations. The present study will vary how participants learn a virtual environment to determine how an existing spatial schema interacts with passive or active learning. It is hypothesized that someone who learns a virtual environment actively will remember more spatial information than someone who learns passively.

**Embodiment, Presence, and Immersion**

When utilizing virtual environments in spatial cognition research, it is important to understand and acknowledge the interaction between the mind and the body. Häfner (2013) explains that embodied cognition is the theory that “the mind and the thoughts produced by it are grounded in the body.” During spatial learning, the body is a key element in cognition. The interaction with the environment and the body is directly influenced by cognition. Sinha and Lopez (2000) explain, “Early spatial schemas are directly grounded in bodily experience, in the sense of movements of one's body and of other objects in relation to one's body.”

In virtual environment training, the kind of environment that is presented and embodied is important to developing a spatial schema. This research also examines presence, or a sense of “being there.” An immersive environment, whether that environment is virtual or real, creates an illusion about a place and other information is often forgotten or ignored. Witmer and Singer (1998) define presence as “the subjective experience of being in one place or environment, even when one is physically situated in another.” Previous research suggests that immersion and affective content in a virtual environment positively influence presence (Baños, Botella, Alcañiz,
Liaño, Guerrero, & Rey, 2004). Witmer and Singer (1998) also suggest that focus and immersion have a strong influence on presence. Another goal of this research is to determine whether there is a specific spatial presence when it comes to Disney theme parks due to the immersive environment.
METHOD

Participants
This study was conducted at the University of Central Florida and had 44 participants. Eighteen participants were male and 26 participants were female. The range of participants’ age was 18-27 with an average of 19.6 years of age ($SD = 2.50$). All participants were awarded with partial course credit in exchange for their participation.

Pre-Screening
A total of 300 participants were pre-screened. This study recruited 22 spatially experienced and 22 non-experienced participants in traversing through Walt Disney World’s Magic Kingdom Park. Their expertise, or spatial experience, was assessed through a questionnaire. The questionnaire assessed the participant’s existing spatial knowledge of Magic Kingdom Park, which is divided into six distinct areas that are Main Street U.S.A., Tomorrowland, Fantasyland, Liberty Square, Frontierland, and Adventureland. In order to balance the questions, there were two spatial questions and two factual questions about each section of the park. All twenty-four questions were multiple-choice. It was theorized that the participants experienced with Magic Kingdom have an existing spatial schema for the park.

Experience was defined by how participants scored on the spatial questionnaire about Magic Kingdom Park. Participants who scored in the top 30% were considered spatially experienced and participants who scored in the bottom 30% were considered non-experienced. Those participants in that scored in the middle 40% were not included in the second part of the study.

In addition, the questionnaire asked participants how often they went to Magic Kingdom Park in a month and in a year. It asked when the last time they visited Magic Kingdom Park was
and whether they were annual passholders or cast members. Any participants who had reported visiting Disneyland in California or had played the game “Disneyland Adventures” on the XBOX 360 Kinect were disqualified from participating after the initial pre-screening. The frequency of visits, as well as being an annual passholder or cast member was later analyzed but not used as a measure of experience. Participants were contacted through Sona Systems after their pre-screening was scored and asked to participate in the second part of the study.

Materials and Apparatus
The experiment was set up in two offices right next to each other in the Psychology faculty suite. The equipment in the offices included televisions, iMac computers with iChat, an XBOX 360 and Kinect sensor, an HDMI cable, and a DVD recorder.

The televisions were two identical Dynex 32-inch televisions that displayed the XBOX 360 game “Disneyland Adventures.” The game required an XBOX 360 and an XBOX Kinect sensor. In order to have a live audio feed in two rooms, iChat was used on an iMac computer in each office and a voice call was initiated before every session. Each television screen displayed the same image from the Disneyland Adventures game. This was accomplished by using an extended HDMI cable. The XBOX 360 was connected to a television and the accompanying television was connected to the DVD recorder in order to display the game. The HDMI cable was connected to the DVD recorder and the television in the next room so that the image of the game could be simultaneously displayed. Refer to Figure 1 for the design of the experiment.
Figure 1: Design of Experiment

The data assessing participants’ route knowledge was recorded with a DVD recorder and later transferred from the hard drive of the DVD recorder to DVDs. As well, participants used a 21.5-inch iMac to complete the survey of Disneyland Park.

Procedure
All participants learned the Disneyland Park through the virtual environment provided by the XBOX 360 Kinect: Disneyland Adventures game. Refer to Figure 2 for an example of the interface of the game. Note that there was not a map of Disneyland Park on the interface.
Half of the participants learned passively and the other half of participants learned actively. Spatially experienced and non-experienced participants of Magic Kingdom Park were randomly assigned to the passive or active condition. There was always one spatially experienced and one non-experienced participant matched for every trial, resulting in 11 spatially experienced participants who learned actively, 11 spatially experienced participants who learned passively, 11 non-experienced participants who learned actively and 11 non-experienced participants who learned passively.

Participants who learned actively were greeted and instructed by a Disney “tour guide” (the researcher) who gave directions from a script to stay on a specific path through Disneyland. The participants who learned passively simultaneously watched the traversal (with the
supervision of a research assistant) of the active participant in another room along with the live audio feed of all of the instructions. Each participant heard the same instructions from the script before and during the navigation. This was the script used before the learning phase in order to allow participants to familiarize themselves with navigating in the virtual environment:

“Hello and thank you for agreeing to participate. Today, we will be learning Disneyland Park. In the room that I am in, the participant will be learning actively in the virtual environment and the participant in the next room will be learning passively. First, I will allow the participant in the room with me to get comfortable in the virtual environment. In the other room, please stand by. I will let you know when we are done.

(To active participant) Now, you will be navigating through this 3D environment using the XBOX Kinect. Please stand on the tape on the floor and center your body in front of the Kinect sensor. In order to move forward, you will put your arm directly in front of you. To turn, move your arm in the direction that you wish to move. I will demonstrate for you. Now it is your turn. Let’s take some time for you to get used to moving in this environment now. Do you have any questions?”

The time to get comfortable with the virtual environment took approximately two to three minutes. The passive participant could hear the conversation between the researcher and active participant during the training with the Kinect sensor. Participants in the passive condition would have this same opportunity to practice moving around in the virtual environment with the Kinect sensor before the assessment phase.

Upon instruction from the researcher or research assistant, each participant stood 72 inches in front of identical 32-inch television screens in either learning condition (passive or active). Participants were told that they would be assessed on their spatial learning. Participants were instructed to move through the virtual environment by putting their arm straight in front of themselves and toward the Kinect sensor. Movement through the virtual environment occurred by moving one’s arm in the direction they were instructed to move. This movement in the virtual
environment is an unnatural way of moving due to the position of one’s arm, and is not typical of active learning in a virtual environment. Refer to Figure 3 for a photo of the arm guided movement.

Figure 3: Movement in Virtual Environment

This was the continued script for the learning phase through the virtual environment of Disneyland Park:

“Hello, I am your Disney Tour Guide. I will be instructing you on a precise path on which you must stay during our tour around Disneyland. As well, please only move your body in the virtual environment as I instruct you to do so. Please ignore any directional information that the game might give you. For example, if you see a yellow path being created in front of you -- simply ignore it.
Please remember that you will be tested on what you have learned so pay close to attention to the names of places and where places are located that I point out to you. You will only be tested on the things that I point out. Again, pay close attention to the names and locations of things that I mention. This will be important later when you are asked to remember what you have learned.

Head down **Main Street USA**, on the RIGHT you will see **Great Moments with Mr. Lincoln**. To the LEFT of that building, you will see the **Mad Hatter**. Turn around and walk straight. You will see the **Emporium** in front of you on the LEFT side of Main Street. Continue down Main Street USA, you will see the **Main Street Cinema** playing **Steamboat Willie** on the RIGHT. Continue down Main Street USA. You will see the **Penny Arcade** on the LEFT.

Continue walking straight and you will see the **Partner’s Statue**. Continue around the Partner’s Statue, take the second exit, and you will see the **Sleeping Beauty’s Castle**. You will pass the **Minnie Mouse** and a double decker bus. Turn to your RIGHT and you will enter **Adventureland**. Notice the **Enchanted Tiki Room** on the LEFT.

Walk past Aladdin. Keep walking straight and you will see the **Jungle Cruise** on your LEFT. You will continue walking and notice **Baloo** on the RIGHT side of the **Jungle Cruise**. After that, on the LEFT is the **Indiana Jones Adventure**. Keep walking straight and veer to the RIGHT and **Tarzan’s Treehouse** will be in front of you.

Walk to the RIGHT of the **Tarzan’s Treehouse** and you will enter **New Orleans Square**. Veer to your LEFT and you will notice the **Pirates of the Caribbean** on the LEFT. Continue to veer to your LEFT and you will pass Princess Tiana on the RIGHT. Continue walking straight and you will see the **French Market** on your LEFT. Walk around the restaurant, and behind it you will see the **Disneyland Railroad**. Turn around and veer to your RIGHT and you will see the **Haunted Mansion** on the LEFT.

Keep walking straight and you will enter **Critter Country**. On the LEFT you will be passing **Splash Mountain**. Continue walking straight and head to the LEFT around Splash Mountain. You will see the **Hungry Bear Restaurant** on the RIGHT and Brer Fox on the LEFT by the entrance to Splash Mountain. Continue to walk straight and you will see the **Many Adventure of Winnie the Pooh** on your RIGHT.

You will now turn around (put your arm behind you to turn around) and head back in the direction in which we entered Critter Country. This area is a dead end. Head around Splash Mountain, pass the Haunted Mansion so that we follow the **Rivers of America** around towards **Frontierland**.

We are now taking the bridge from **New Orleans Square** to **Frontierland**. As you enter **Frontierland**, you will walk straight and pass the **Stage Door Cafe** and see the **Golden Horseshoe** on the RIGHT. Turn around towards the **Rivers of America** and head to the RIGHT. On the LEFT, you will see a steam engine boar named the **Mark Twain Riverboat**.
Continue on the path straight ahead and you will see Big Thunder Mountain Railroad on the RIGHT.
Continue walking straight around Big Thunder Mountain and head to the RIGHT where you will enter Fantasyland.
You will be veering to your RIGHT for a while before entering Fantasyland.
We will now be taking a five-minute break.
Put your arms up to pause game.”

Halfway through the task, all participants were given a “break,” or distractor task, in order to prevent fatigue. The task was the Perspective Taking/Spatial Orientation Test (Hegarty & Waller, 2001).

“Now, as you enter Fantasyland, you will continue to walk straight.
After that, you will see Dumbo the Flying Elephant on your LEFT and The King Arthur Carousel on your RIGHT.
After the Carousel, veer to the RIGHT and you will see Mr. Toad’s Wild Ride in front of you.
Keep walking to the RIGHT of Mr. Toad’s Wild Ride, and you will pass Peter Pan’s Flight on your LEFT.
Continue around the circle around the carousel and you will see Pinocchio's Daring Journey on your LEFT.
Continue past the Carousel to the RIGHT and walk straight. You will see the Mad Tea Party on your RIGHT.
After you pass the Mad Tea Party, keep walking straight and make a LEFT. Continue straight and “it's a small world” is right in front of you. Turn all the way around.
Continue forward and walk under the monorail bridge.
Now you will walk by the Matterhorn Bobsleds on your RIGHT and you will continue walking straight until you enter Tomorrowland.
When the road splits off into two, take the left and rotate your body to the left and you will Finding Nemo Submarine Voyage.
Turn around and walk straight, you will see Innoventions in front of you.
Walk towards the LEFT side of the Innoventions building and you will see Autopia on the LEFT.
Turn all the way around, and directly in front of you, you will see Tomorrowland Terrace.
Make a LEFT and keep walking straight. You will pass Pizza Port on the LEFT and to the RIGHT of that, you will see Space Mountain.
Walk past Space Mountain, and you will see Captain EO on the RIGHT of Space Mountain.
Keep walking straight and pass StarCade and Star Traders and you will see Star Tours on the LEFT and Buzz Lightyear Astro Blasters on the RIGHT. Keep walking straight and you will see Astro Orbiter and you will return to where we started on MAIN STREET USA.”

There were two participants matched through this design during every trial. This matched-yoke design (Keenher et al., 2008) was used in order to control for the time of the traversal and any variations of movement that might have occurred through the interpretation of the directions from the researcher. Thus, all matched participants experienced the exact same visualizations from the virtual environment and heard the same directional instructions that could have varied from the script. The training phase took approximately thirty to forty minutes. The goal of this procedure was to visit the attractions that both Magic Kingdom Park and Disneyland Park have in common.

After the learning phase was complete, the participants switched rooms. The participant in the active condition was now in the room that the participant in the passive condition was in during the learning phase, and visa versa. The participant in the active condition took a survey in the “passive condition room” and the participant in the passive condition took a navigation assessment in the “active condition room.” This room switching was done because the participants in the passive condition had a clear disadvantage when it came to learning the spatial information over the participants in the active condition. Thus, the purpose of having the participants in the passive condition perform the navigation assessment first was to give them an equal advantage in remembering the spatial information they had just learned. When the participant in the passive condition completed the navigation assessment, he or she returned to the initial room they were in to complete the survey and the participant in the active condition
returned to his or her initial room to complete the navigation assessment. In other words, the participant who learned passively was assessed on route knowledge first, while the active participant was assessed on survey knowledge first.

**Dependent Variables**

To measure whether a Magic Kingdom spatial schema influences the ability to learn Disneyland, participants’ route knowledge was tested in a navigation assessment by asking them to connect landmarks into routes through seven pre-determined checkpoints that they had to route to and from in the virtual environment of Disneyland in the XBOX 360 Kinect game. Participants were told that they would be stopped after 15 seconds if they were walking in a direction that would not get them to the desired checkpoint.

Participants were scored on two things from the navigation assessment. They were assessed on (1) the total number of checkpoints found and (2) the number of errors made. An error included turns the wrong direction and completely walking into the wrong land of Disneyland Park in the virtual environment. The checkpoints were as followed:

1. The Penny Arcade to the Enchanted Tiki Room
2. The Jungle Cruise to the Emporium
3. Star Tours to the Matterhorn Bobsleds
4. Dumbo The Flying Elephant to “it’s a small world”
5. Pirates of the Caribbean to the Many Adventures of Winnie The Pooh
6. The Haunted Mansion to the Mark Twain Riverboat
7. Peter Pan’s Flight to “Captain EO”
In addition, the participants were tested on their survey knowledge by completing a twenty-five question spatial survey about Disneyland Park. This survey was similar to one that assessed their Magic Kingdom Park spatial experience.

**Magic Kingdom Park vs. Disneyland Park**

The participants learned Disneyland Park located in California in a virtual environment using the XBOX 360 Kinect: Disneyland Adventures game. Magic Kingdom Park and Disneyland Park in California are strikingly similar. Although these two theme parks share similarities (e.g., names and locations of landmarks), they also have clear distinctions. Disneyland opened in 1955 in Anaheim, California and Magic Kingdom Park open in Orlando, Florida in 1971. Magic Kingdom Park and Disneyland, California are both designed in a similar nature. The guests enter the park through Main Street USA and at the end of the street they are faced with a princess’ castle. There is a central “hub” that connects the area around the castle to the various themed “lands” around the park. Each “land” is unique and is prominently different in narrative to the others.

Both theme parks have “lands” in common and are situated in relatively the same place. A few characteristics vary, such as what “lands,” or areas of the park, are home to what attractions. For example, in Magic Kingdom Park, the Haunted Mansion is located in Liberty Square and Pirates of the Caribbean is located in Adventureland (Figure 4). In Disneyland Park, however, both attractions are located in New Orleans Square (Figure 5). Both parks have lands in common that include Main Street U.S.A., Tomorrowland, Fantasyland, Frontierland, and Adventureland. However, Disneyland has lands exclusive to its park like Critter Country, New
Orleans Square, and Mickey’s Toontown, whereas the only land that Magic Kingdom Park exclusively has is Liberty Square.

The strong similarities and differences between the two theme parks are extraordinarily significant. It creates a perfect environment to study spatial schemata and the confusion that might occur with spatial cognition of similar places. These two theme parks are similar due to the mirrored location of the lands and location of the attractions they have in common. The Jungle Cruise, Pirates of the Caribbean, the Haunted Mansion, Splash Mountain, Peter Pan’s Flight, and Space Mountain are just a few of the attractions both theme parks have in common.
Figure 4: Map of Disneyland Park
Figure 5: Map of Magic Kingdom Park
HYPOTHESES

The research hypothesis was that those with spatial experience in Magic Kingdom Park would have memory interference from their existing spatial knowledge and schemata. The spatially experienced participants were expected not to perform as well as the spatially inexperienced participants in routing Disneyland Park and were expected to have weaker survey knowledge (i.e., mental map-like memory) of Disneyland Park. Route knowledge of Disneyland Park was measured by the navigation assessment and survey knowledge was assessed by the spatial questionnaire. In addition, it was hypothesized that active learning would result in better route and survey knowledge of Disneyland Park than passive learning in both groups of participants.
RESULTS

As previously mentioned, participants who scored in the top 30% were considered spatially experienced and participants who scored in the bottom 30% were considered non-experienced. Spatially experienced participants answered an average of 20.14 ($SD = 2.22$) questions correctly on the twenty-four-item pre-screening survey whereas the spatially non-experienced participants answered an average of 5.55 ($SD = 1.47$) questions correctly. On average, spatially non-experienced participants reported that they never went to Magic Kingdom Park or they went less than once a month during one calendar year. On average, spatially experienced participants reported an average of going to Magic Kingdom Park at least once a month every year. In addition, of the spatially experienced participants, two participants were cast members and five were annual passholders. There was not a significant difference between reported perception of presence in the virtual environment and learning condition.

A 2 2 (experience by learning condition) univariate ANOVA was conducted for each dependent variable. There was not an interaction between spatial experience of Magic Kingdom park and training condition for survey assessment $F(1, 40) = .01, p = .920$, the numbers of places found in the navigation assessment $F(1, 40) = .228, p = .636$, or the number of errors made in the navigation assessment $F(1, 40) = 3.15, p = .083$.

In addition, there was a main effect for experience for each of the dependent variables. Experienced participants ($M=16.32, SD=3.06$) outperformed the non-experienced ($M=12.14$, $SD=2.78$) participants on the number of questions answered correctly on the Disneyland survey, $F(1, 40) = 21.44, p < .001$ (Figure 6). Similarly, experienced participants ($M=4.82, SD=1.84$) outperformed the non-experienced ($M=1.77, SD=1.23$) participants on the number of places
found in the navigating assessment, $F(1, 40) = 40.88, p < .001$ (Figure 7). Experienced participants ($M=9.14$, $SD=4.63$) made fewer errors in the navigating assessment than non-experienced participants ($M=15.77$, $SD=3.41$), $F(1, 40) = 31.77, p < .001$ (Figure 8).

There was not a main effect for learning condition. There was not a significant difference between passive ($M=14.14$, $SD=3.93$) and active ($M=14.32$, $SD=3.29$) training conditions for the number of questions answered correctly on the Disneyland survey, $F(1, 40) = .041, p = .841$. As well, there was not a significant difference between passive ($M=3.05$, $SD=2.28$) and active ($M=3.55$, $SD=2.11$) training conditions for the number of places found in the navigation assessment, $F(1, 40) = 2.75, p = .300$. There was not a significant difference between passive ($M=13.36$, $SD=4.57$) and active ($M=11.55$, $SD=5.79$) training conditions for the number of errors made in the navigation assessment, $F(1, 40) = 2.39, p = .130$. 
This graph demonstrates that participants experienced with Magic Kingdom Park answered more questions correctly on the survey about Disneyland Park than non-experienced participants, regardless of the training condition.
Figure 7: Places Found in Navigation Assessment Graph

This graph demonstrates that participants experienced with Magic Kingdom Park found more places in the virtual environment of Disneyland Park than non-experienced participants, regardless of training condition.
Figure 8: Errors Made in Navigation Assessment Graph.

This graph demonstrates that participants experienced with Magic Kingdom Park made fewer errors than non-experienced participants, regardless of training condition.
DISCUSSION

Having the chance to study a local theme park provides a unique opportunity to study spatial cognition and virtual environments. This study explored how similar mental maps or places affect our schemata. The results suggest that a well-developed spatial schema transfers to a similar environment. Existing spatial knowledge matters, in this case, because the existing schema helps with learning the similar location. Mandler’s incongruity theory (1982) explains these current findings. Mandler proposed that when information is introduced that does not match our existing schema system, it is schema-incongruent, which can lead to increased stimulation (McQuarrie & Mick, 1992) due to schema violation. In terms of memory, incongruent messages or advertisements with familiar products have shown increased recall (Lange & Dahlen, 2003) that can be explained by the saliency of incongruity (Sujan, Bettman, & Sujan, 1986). In other words, the spatial information of Disneyland Park was better remembered by the participants experienced with Magic Kingdom Park because the incongruent spatial knowledge created an increased saliency and stimulation. Participants who had no experience with Magic Kingdom Park had no existing spatial information to strike them as different from Magic Kingdom Park, and thus, it was easier for experienced participants to incorporate the new, different spatial information into their existing spatial schema.

It was originally hypothesized that experienced participants would struggle because the two different representations would create memory interference from the participants’ existing spatial knowledge and schemata. Instead, it actually facilitated learning a similar place. Unlike the Woollet and Maquire’s study (2010), there was an overlay of spatial information from Magic Kingdom Park and Disneyland Park, as opposed to an entirely new section (of London) that was
being learned. Instead, the representation, or mental map, of Magic Kingdom Park was simply adjusted to learn Disneyland Park, and thus, there were not an entirely new representation being developed.

An intriguing finding from this study was that the training condition (passive or active) had no significant influence on how experienced or non-experienced participants of Magic Kingdom Park learned Disneyland Park. The data suggests that whether there is “good” or “bad” spatial training, having a spatial schema had a significant impact on memory. In other words, the real world experience transferred to learning a virtual environment due to an existing spatial schema.

There are a few limitations of this study that may explain why there was not a main effect for learning condition. The active training condition is not the traditional active training. Typically, studies exploring learning in a virtual environment allow the participant to move of their own volition and with a keyboard, joystick, or a head-mounted display (Waller et al., 1998; Wilson, 1999; James et al., 2002). In this present study, participants were instructed on a specific path to stay on, so participants were not able to manipulate their environment how they wished. In addition, the way the participants interacted with the interface of the virtual environment in order to move the avatar was unnatural. Perhaps the gesture of putting one’s arm perpendicular to the body in order to move forward was distracting and did not simulate real movement in a spatial world.

The perception of similar places affecting a person’s schema has some practical advantages and disadvantages. When it comes to marketing, companies can increase profits by “forcing” people to spend more time navigating through stores that violate a consumer’s spatial
schema. For example, Publix often varies the location of certain areas in their stores, like the produce section. It forces the consumer to spend more time looking for items and possibly passing by something they would not normally purchase or did not plan on purchasing.

While this may be an advantage for businesses, it can be a disadvantage for consumers and spatial experts. These experts may inevitably spend more time navigating through a space with conflicting spatial schemata. However, this study suggests that spatial experts may struggle a bit at first in a similar environment, but they will soon incorporate the new, salient information into their spatial schema. It becomes easier to navigate that new, different environment for a spatial expert than for someone who has no existing spatial knowledge of a similar environment.

This research will continue to look into theories of transfer of expertise in spatial cognition as well as the influence of schemata in everyday spatial activities. Future research should explore how a person with spatial experience could navigate a similar environment with no training in order to determine if interference occurs between the two representations. In the context of spatial expertise, research should examine schematic routes versus non-schematic routes in order to look at spatial interference of similar environments. Furthermore, future research should explore those people who are in the middle of being a spatial expert and spatial novice. How much existing spatial knowledge is necessary for a well-developed spatial schema? This could affect how virtual environment training is produced, as well as future urban, commercial developments.
APPENDIX A: IRB APPROVAL LETTER
Approval of Human Research

From: UCF Institutional Review Board #1
FWA0000351, IRB00001138

To: Valerie K. Sims and Co-PI: Daphne E. Kopel

Date: July 25, 2013

Dear Researcher:

On 7/25/2013 the IRB approved the following human participant research until 7/24/2014 inclusive:

Type of Review: Submission Correction for UCF Initial Review Submission Form
Expedited Review
Project Title: Distortion of Spatial Schemata through Theme Park Experiences
Investigator: Valerie K. Sims
IRB Number: SBE-13-09492
Funding Agency: Office of Undergraduate Research (OUR)
Grant Title: n/a
Research ID: n/a

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu.

If continuing review approval is not granted before the expiration date of 7/24/2014, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in IRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Patria Davis on 07/25/2013 11:20:05 AM EDT

IRB Coordinator
APPENDIX B: PRE-SCREENING QUESTIONNAIRE
**Pre-Screening:**

This survey will evaluate your time spent at Magic Kingdom Park, as well as your spatial knowledge of the theme park. Please answer honestly and take your time.

Please remember that while you are answering questions specifically asking about Magic Kingdom Park, not to include time spent at any of the other theme parks in Walt Disney World (including Disney’s Hollywood Studios, Epcot, or Disney’s Animal Kingdom)

Please enter your SONA ID here to receive credit.

Q1 How many times have you been to Magic Kingdom Park in your lifetime?

- Never
- Less than Once a Month
- Once a Month
- 2-3 Times a Month
- Once a Week
- 2-3 Times a Week
- Daily

Q2 How often do you go to Magic Kingdom Park in a year?

- Never
- Less than Once a Month
- Once a Month
- 2-3 Times a Month
- Once a Week
- 2-3 Times a Week
- Daily

Q3 How often do you go to Magic Kingdom Park in a month?

- Never
- Less than Once a Month
- Once a Month
- 2-3 Times a Month
- Once a Week
- 2-3 Times a Week
- Daily

Q4 When is the last time you went to Magic Kingdom Park?
Q5 What is your favorite Walt Disney World theme park?
- Magic Kingdom Park
- EPCOT
- Disney's Hollywood Studios
- Disney's Animal Kingdom

Q6 Are you a Disney Annual Passholder?
- Yes
- No

Q7 Have you ever been to Disneyland Park in California or have you ever played the XBOX 360 Kinect game, Disneyland Adventures?
- Yes
- No

Q8 Have you ever been to Disneyland Park or Tokyo Disney?
- Yes
- No

Q9 Have you ever been a Disney World Cast Member? If yes, where did you work?
- Yes ____________________
- No

Q11 Have you ever used the My Disney Experience App on your smart phone?
- Yes
- No

Q12 Have you ever used the map feature in the My Disney Experience App on your smart phone?
- Yes
- No
Q13 On a scale of 1-10 (with 10 being the most), how much would you say you like the Walt Disney World Theme Parks?

○ 1
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7
○ 8
○ 9
○ 10

Q14 What is your favorite attraction at Walt Disney World?

The following questions will evaluate your spatial knowledge of Magic Kingdom Park.

Q16 If you are standing on Main Street, U.S.A. with Cinderella's Castle in front of you, which land would be to your right?

○ Adventureland
○ Liberty Square
○ Tomorrowland*
○ Frontierland
○ Fantasyland

Q17 What attraction is closest to the restaurant, Tortuga Tavern (formerly known as El Pirata y el Perico)?

○ Pirates of the Caribbean*
○ Haunted Mansion
○ Tom Sawyer's Island
○ Space Mountain
○ Magic Carpets of Aladdin
Q18 What is the name of the place where you can purchase Dole Whip?
- Casey's Corner
- Aloha Isle*
- Cheshire Cafe
- Sleepy Hollow
- Sunshine Tree Terrace

Q19 When you first enter the Magic Kingdom, what restaurant is on your right?
- The Friar's Nook
- Sunshine Tree Terrace
- Columbia Harbour House
- Tony's Town Square*
- Casey's Corner

Q20 What is the one attraction in Magic Kingdom that requires an additional cost?
- Tomorrowland Speedway
- Frontierland Shootin' Arcade*
- Swiss Family Treehouse
- The Hall of Presidents
- Tom Sawyer's Island

Q21 What’s the name of the island in Magic Kingdom that requires you take a raft to get to it?
- Tom Sawyer's Island*
- Astro Orbiter
- The Liberty Square Riverboat
- Walt Disney World Railroad
- Tomorrowland Speedway

Q22 Where can you buy funnel cake?
- Aloha Isle
- Sleepy Hollow*
- Peco's Bill Tall Tale Inn & Cafe
- Cheshire Cafe
- Sunshine Tree Terrace
Q23 What is the name of the largest Quick Service Food location in Magic Kingdom?
- Casey's Corner
- Peco's Bill Tall Tale Inn & Cafe
- Tomorrowland Terrace
- Cosmic Rays*
- Pinocchio Village Haus

Q24 What attraction takes your picture in Tomorrowland?
- Stitch's Great Escape
- Astro Orbiter
- Tomorrowland Transit Authority
- Buzz Lightyear's Space Ranger Spin*
- Monsters, Inc. Laugh Floor

Q25 Select the table service restaurant in Liberty Square.
- Columbia Harbour House
- The Diamond Horseshoe*
- The Crystal Palace
- The Lunching Pad
- Cosmic Rays

Q26 In what lands or areas of the park does the Walt Disney World Railroad NOT stop?
- Main Street, U.S.A.
- Adventureland*
- Frontierland
- Fantasyland

Q27 What passes through Main Street, U.S.A. every day at 3pm?
- Move It! Shake It! Celebrate It! Street Party
- SpectroMagic
- Celebrate A Dream Come True Parade*
- Main Street Electrical Parade
- Wishes: Nighttime Spectacular
Q28 If you have the Jungle Cruise to your right, what attraction is directly on your left?
- Magic Carpets of Aladdin*
- Mickey's Philharmagic
- Pirates of the Caribbean
- Space Mountain
- Big Thunder Mountain Railroad

Q29 Which character can you meet in Adventureland?
- Mickey Mouse
- Tinker Bell*
- Donald Duck
- Rapunzel
- Merida

Q30 What attraction is in between Splash Mountain and Big Thunder Mountain Railroad?
- Walt Disney World Railroad*
- Haunted Mansion
- Peter Pan's Flight
- Carousel of Progress
- Country Bear Jamboree

Q31 What is the only 3D show in Magic Kingdom?
- Country Bear Jamboree
- Hall of Presidents
- Mickey's Philharmagic*
- Enchanted Tiki Room
- Monsters, Inc. Laugh Floor

Q32 What is the name of the place where young girls can get princess makeovers?
- Mad Tea Party
- Bibbidi Bobbidi Boutique*
- Enchanted Tales with Belle
- Crystal Palace
- Prince Charming Regal Carousel
Q33 If you are standing right in front of Splash Mountain on the bridge that is closest to the attraction, what land is to your left?
- Adventureland*
- Liberty Square
- Tomorrowland
- Fantasyland
- Main Street, U.S.A.

Q34 When you exit the Haunted Mansion, what attraction is on your left?
- It’s a Small World*
- The Liberty Square Riverboat
- The Hall of Presidents
- Dumbo the Flying Elephant
- The Jungle Cruise

Q35 If you had the Hall of Presidents behind you, what store would be directly in front of you? (to the left of the Liberty Tree)
- The Christmas Shoppe*
- Mickey's Star Traders
- The Emporium
- Chapeau
- Yankee Trader

Q36 If you were standing with your back towards Space Mountain, what attraction would you see in the sky?
- Tomorrowland Speedway
- Tomorrowland Transit Authority People Mover*
- Buzz Lightyear's Space Ranger Spin
- Dumbo the Flying Elephant
- Swiss Family Treehouse

Q37 What attraction is to the left of Buzz Lightyear’s Space Ranger Spin entrance?
- Carousel of Progress*
- Monsters, Inc. Laugh Floor
- Stitch's Great Escape
- Jungle Cruise
- The Barnstormer
Q38 If you are standing with the back of Cinderella’s castle behind you, what attraction is in front of you?
- Tomorrowland Transit Authority People Mover
- Prince Charming Regal Carrousel*
- Peter Pan's Flight
- Pete's Silly Sideshow
- Under the Sea - Journey of the Little Mermaid

Q39 If you have The Many Adventures of Winnie the Pooh to your right, what is the nearest attraction to your left?
- The Mad Tea Party*
- The Haunted Mansion
- It's A Small World
- The Hall of Presidents
- Peter's Pan's Flight
APPENDIX C: SURVEY ASSESSMENT OF DISNEYLAND
**Disneyland Survey Assessment:**

Please enter your SONA ID to receive credit

Please answer the following demographic questions:

Q1 Please select your gender
   - male
   - female

Q2 Please select your age
   - 18
   - 19
   - 20
   - 21
   - 22
   - 23
   - 24
   - 25
   - 26
   - 27
   - Over 28

Q3 During the experience with the virtual environment of Disneyland Park, I felt a sense of truly being there.
   - True
   - False

Q4 I have had prior experience with an XBOX Kinect
   - True
   - False
Please answer the following questions about your spatial experience in the virtual environment of Disneyland Park:

Q5 What is the first store on the left side of Main Street?
- Emporium*
- Main Street Confectionery
- Chapeau
- Mad Hatters

Q6 What is the first attraction you saw when you entered Adventureland?
- The Enchanted Tiki Room*
- Pirates of the Caribbean
- The Jungle Cruise
- Magic Carpets of Aladdin

Q7 What movie is playing in the Main Street Cinema?
- Steam Boat Willie*
- 101 Dalmations
- Snow White and the Seven Dwarfs
- Great Moments with Mr. Lincoln

Q8 What attraction in New Orleans Square is on the border of Critter Country?
- The Haunted Mansion*
- Splash Mountain
- The Many Adventures of Winnie the Pooh
- The Disneyland Railroad

Q9 What attraction is to the right of meeting Aladdin?
- The Jungle Cruise*
- Magic Carpets of Aladdin
- Tarzan's Treehouse
- Indiana Jones Adventure

Q10 What attraction is to the right of the store named Mad Hatters?
- The Mad Tea Party
- Great Moments with Mr. Lincoln*
- Emporium
- Star Tours
Q11 What character (besides Aladdin) can you meet in Adventureland?
- Baloo*
- Piglet
- Aurora
- Indiana Jones

Q12 On what side of Main Street is the Penny Arcade?
- Left*
- right

Q13 As you entered Fantasyland, on what side is Dumbo?
- Left*
- right

Q14 What attraction is behind the French Market?
- The Disneyland Railroad*
- The Haunted Mansion
- The Mark Twain Riverboat
- Princess Tiana

Q15 What attraction is on your left as you enter Critter Country?
- Splash Mountain*
- The Many Adventures of Winnie the Pooh
- The Matterhorn
- The Disneyland Railroad

Q16 If you're walking down the street in Tomorrowland with Buzz Lightyear Astro Blasters on the right, what attraction is on your left?
- Star Tours*
- Innoventions
- Finding Nemo Submarine Voyage
- Captain EO

Q17 What attraction in Adventureland is on the border of New Orleans Square?
- Tarzan's Treehouse*
- The Jungle Cruise
- The Enchanted Tiki Room
- Pirates of the Caribbean
Q18 What is the name of the restaurant across from the entrance to Splash Mountain?
- The Hungry Bear Restaurant*
- Peco's Bill Tall Tale Inn & Cafe
- Harbour Gallery
- The Golden Horseshoe

Q19 What is the name of the body of water that is on the other side of the bridge that takes you from New Orleans Square to Frontierland?
- The Rivers of America*
- Davy Crocket's Rivers
- Seven Seas Lagoon
- Mark Twain's Rivers

Q20 What is the name of the restaurant in Frontierland across from the steamboat?
- The Golden Horseshoe*
- Peco's Bill Tall Tale Inn & Cafe
- Stage Door Cafe
- Big Thunder Ranch Barbecue

Q21 If you have the Mad Tea Party to your right, what attraction is on the left side of the park?
- It's A Small World*
- The Matterhorn
- King Arthur's Carousel
- Dumbo the Flying Elephany

Q22 As you walk through Frontierland, on what side of the road is Big Thunder Mountain?
- Right*
- left

Q23 What attraction is at the very end of Critter Country, causing a dead end?
- The Many Adventures of Winnie the Pooh*
- Big Thunder Mountain
- Splash Mountain
- It's A Small World
Q24 What is the name of the steamboat in Frontierland?
- The Mark Twain Riverboat*
- The Liberty Belle
- The Davy Crockett
- Sailing Ship Columbia

Q25 What attraction is to the right of Space Mountain?
- Captain EO*
- Autopia
- Astro Orbiter
- Space Mountain

Q26 What is the name of the first attraction you encountered as you entered New Orleans Square?
- Pirates of the Caribbean*
- The Haunted Mansion
- Tarzan's Treehouse
- Big Thunder Mountain

Q27 Peter Pan's Flight is to the _____ of Mr. Toad's Wild Ride?
- Right*
- left

Q28 What attraction is to the right of Pizza Port?
- Space Mountain*
- Captain EO
- Star Tours
- Innoventions

Q29 As you entered Fantasyland, on what side is King Arthur's Carousel?
- Right*
- left

Q30 What is the attraction that borders Tomorrowland and Main Street USA?
- Astro Orbiter*
- Buzz Lightyear Astro Blasters
- Autopia
- Starcade
REFERENCES


