

FACTORS RELATED TO SOCIAL WAYFINDING:  
ENVIRONMENT, ABILITY, AND ANXIETY

by

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A DISSERTATION

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## ABSTRACT

Two experiments and a qualitative study investigate variables that predict different aspects of wayfinding. The first experiment investigated the extent to which sense of direction, general anxiety, spatial anxiety, gender, and a non-threatening or threatening description of environments predicted perceived threat in the environment. In addition, the experiment compared and contrasted spatial and general anxiety, investigating the nature of these two measures as wayfinding variables. Sense of direction, gender, and the described environment manipulation predicted perceived threat for a walking scenario while general anxiety predicted perceived threat for a driving scenario. The second experiment investigated the extent to which spatial anxiety, general anxiety, perceived threat, the environmental threat description manipulation, and gender predicted likelihood of asking for directions from strangers and acquaintances. Higher general anxiety predicted lower likelihood of asking strangers for directions, while having no predictive value for familiar persons (as expected). The third study was a qualitative analysis of participants' essays remembering their thoughts and behaviors from the last time they were lost or disoriented by themselves, revealing that self-reported descriptions included the variables of interest (thoughts regarding one's sense of direction, anxious feelings, and environmental assessment).

## LIST OF ABBREVIATIONS AND SYMBOLS

e.g.	Exempli gratia or for example
i.e.	Id est or that is
$n$	Sample size
GSD	Good Sense of Direction
PSD	Poor Sense of Direction
$M$	Mean
$SD$	Standard deviation
$f^2$	Effect size
$w$	Effect size for Chi-Square
$t$	Computed value of a $t$ -test
$<$	Less than
$>$	Greater than
$=$	Equal to
$p$	Probability associated with the occurrence under the null hypothesis of a value at least as extreme as the observed value
$r$	Pearson product-moment correlation
vs.	versus
$F$	Computed value of a $F$ test
$\Delta F$	The change in $F$

$\chi^2$	Chi Square
adj. $R^2$	Proportion of variability in a data set accounted for by the statistical model penalized for non-predictive variables
$\Delta R^2$	The change in $R^2$
B	Unstandardized Coefficient from a regression analysis
beta	Standardized Coefficient from a regression analysis
RMSEA	Root means square error of approximation
CFI	Comparative Fit Index

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## 1. INTRODUCTION

Wayfinding is something that everyone has to do every day of their lives. It is being able to get where you need to go: understanding how to get there from where you are, and navigating that space effectively. There are many questions to ask regarding how people move around in their environment. What features of the environment influence their behavior? This question is primarily approached by focusing on the physical shape of spaces such as visible angles and lines of sight (Janzen, Schade, Katz, & Hermann, 2001; Magliano, Cohen, Allen, & Rodrigue, 1995; Tang, Wu, & Lin, 2009). What about the threatening aspects of an environment? What role do individual characteristics and societal factors play in wayfinding, given different environments? Also, what strategies do people use to find their way, especially after becoming lost or disoriented? Most studies investigate how individuals wayfind alone (Heth, Cornell, & Flood, 2002; Lawton, 1994; Kato & Takeuchi, 2003; Shelton & Gabriele, 2004); yet wayfinding is typically a social activity. We go out with our friends, we ask others for directions, and we go to new places being led by others who have been there before us. Basically, what are the factors involved in a wayfinding situation and what role do those factors play regarding when and how we wayfind socially? In this series of studies I investigate the relations among perceptions of environmental threat, spatial and general anxiety, sense of direction, likelihood of asking for directions, gender, and the type of strategies used when lost or disoriented. In the following pages the research on cognitive aspects of wayfinding are introduced first, followed by social/personality aspects of wayfinding.

## 2. COGNITIVE ASPECTS OF WAYFINDING

Subsumed under cognitive aspects of wayfinding are the concepts of cognitive maps, wayfinding strategies, sense of direction, and gender differences in wayfinding. These topics are covered in turn here.

*Cognitive maps.* A cognitive map is a mental representation of the environmental space of interest to the wayfinder. The information in the cognitive map can be represented both visually and verbally. The amount and type of information making up the cognitive map dictates the kinds of wayfinding strategies one is capable of using (Miyaki, Friedman, Rettinger, Shah, & Hegarty, 2001). Cognitive maps develop through a sequence of four stages (Heth, Cornell, & Flood, 2002). In the first stage, an individual becomes familiar with the landmarks which populate a space. In the second stage, small pathways are connected between landmarks. In the third stage, these small landmark-connected pathways start to become linked by larger routes. Finally, in the fourth stage, all of the landmark and route information of the environment become framed within the universal constants that make up any physical space (e.g. directions of cardinality, mountains and rivers). When all four stages have been completed, the cognitive map is mature and full of complex and useful material called survey information. Early cognitive maps are mostly made up of route information and are generally landmark based.

*Wayfinding strategies.* A large portion of the work being done with wayfinding literature pertains to strategy use, because early research has demonstrated that strategy selection relates to wayfinding performance (Lawton, 1994). Researchers studying strategy use among wayfinding

individuals have found it most useful to separate the strategies into two distinct categories: route and survey strategies (Lawton, 1994; Shelton & Gabriele, 2004). Route strategies employ the kind of information that is made part of the cognitive map in its earliest stages of development. These strategies are often verbal and sequential in nature, making use of available landmarks to create a step-wise course of action for navigating to a desired location (e.g. “Turn left at the gas station and turn right at the third stoplight.”). Survey strategies employ the kind of information found in mature cognitive maps, employing all of the landmark, route, and survey information available in an environmental space (e.g. “My work is north from your house, beyond the city park.”). Survey strategies employ greater amounts of complex information than route strategies, and are considered more effective than route strategies. Compared to route strategy use, survey strategy use predicts superior wayfinding performance (Lawton, 1994). Consider the fact that, should one’s path be obstructed while following a sequence of route strategies, one does not have the information necessary to create an alternate route to one’s destination. However, if one is given an obstacle, and has survey information about the environmental space encoded within one’s cognitive map, one is still capable of understanding which direction one needs to be going, and what alternative pathways are available.

Several studies have shown that different kinds of strategies are used depending on experience with the environment. For example, Spiers and Maguire (2008) recruited 20 male London taxi drivers who had lived in London the majority of their lives. In the study they took “fares” through a virtual simulation of Central London that realistically simulated over 70 miles of drive-able roads and 20 square miles of city. Two weeks prior to data collection each participant was given two hours of practice familiarizing themselves with the navigational

controls for driving the virtual taxi cab. In the actual experiment the cab drivers picked up seven different customers. Each customer was driven to distinct locations in the city. While they performed these tasks the virtual display and the drivers' faces were video recorded. The key manipulation was that all routes involved the customers changing their minds regarding their destination soon after departing their pick-up locations. Three routes involved changes in instructions partway into the ride (e.g., either travel via/or avoid specific locations). The other four contained no special instructions dictating specific routes to be used. After completing all routes, the taxi drivers watched a recorded visual display of their performance and, as they watched their recording, they described in detail the thought processes that occurred while wayfinding.

The drivers indicated that they formed a mental pathway first, typically by recalling the destination's allocentric location, and then determined its direction from their current position. Specifically, they described images of the city from a bird's eye view (i.e., survey view), or they stated that they saw through the buildings to locate the destination. They often needed to plan a series of turns through congested one-way streets simply to place themselves on the correct heading towards the desired zone of the destination. The city was frequently described in terms of regions or large zones interconnected through shared routes (main roadways acting like boundaries between the regions). The drivers also stated that they constantly surveyed the environment for expected landmarks to confirm their intended movement.

In planning the route, they sometimes began by partially planning it, then waiting to make more fine tuned decisions once they entered a desired region. Should a street be closed (an event frequently occurring on London's roadways), the drivers rattled off diverse alternatives

that they could take. Frequently thoughts such as these were triggered by the recognition (or absence) of an expected landmark. However, the majority of the time was spent in what the experimenters referred to as “coasting.” When the drivers felt themselves being “turned off” or having “auto-pilot” take over, they described most decisions as being made rapidly, with opportunities quickly recognized with little or no effort; they just “knew where they needed to be going” (page 237). Overall, the drivers’ descriptions reveal that they rely on a complex cognitive representation (map) of London that includes both route and survey information. Their ability to make rapid decisions while wayfinding in their environment indicates that the cognitive map is also easily accessible.

Cazzato, Basso, Cutini, and Bisiacchi (2010) also demonstrated the importance of being able to fluidly integrate multiple strategies for successful navigational behavior. Rather than getting qualitative descriptions of the strategies used, the researchers were interested in looking for frequent shifts in different kinds of strategies, based on the behaviors of timed pauses and eye movements while participants were involved in the experimental task.

In this task, participants were to navigate a salesman through a city to a final destination, stopping at eight locations on the way, while traveling along a path that used the shortest distance possible. The city was displayed as a grid seen from a bird’s eye view. As soon as the trial started, the participants saw their salesman’s location, the destination point, and the eight places they needed to stop along the way. Using the arrow keys on a keyboard, the participants were instructed to guide the salesman to the destination, stopping at every required spot along the way, using the shortest route possible and in as little time as they could manage. The participants placed their faces against a harness so that their eye movements could be measured.

The researchers argued that strategy shifts while engaged in the task could be identified by the participants' pauses at intersection choice points accompanied by a visual search across the entire map surface, demonstrated by large eye movements. In contrast, a participant using a single strategy would move smoothly through an intersection without needing to scan areas of the map, demonstrated by a lack of large eye movements.

Those participants who navigated the salesman along the shortest (most efficient) pathways were more likely to have large eye movements, indicating a pattern of frequently changing strategies. They also tended to be the quickest at completing the task, which seems especially interesting considering they were more likely to take pauses and re-evaluate their position within the larger framework of the environment. At first glance, this appears counter-intuitive. Why would the participants completing the task the quickest be the same ones taking frequent pauses? The researchers argued that taking the time to shift strategies decreased the likelihood of larger time losses associated with making inefficient wayfinding choices. These results align with those from the expert cab drivers in the previous study.

One final study investigating strategy use focuses on both the importance of survey strategy use and the changes in strategy use as one becomes familiar with an environment (Hutcheson, 2004). In this unpublished undergraduate honors thesis, Hutcheson had participants first explore a virtual environment. The virtual environment consisted of a first person view of a building's interior with differently colored rooms connected by a main corridor. Then they were asked to navigate to specific rooms, each time beginning at the entrance to the building. The time it took them to locate each room was recorded. Afterward, they were asked to imagine themselves in a specific room and then indicate the location of another room. Most important,

after having completed the wayfinding task, each participant went through an exhaustive list of spatial strategies (Prestopnik, 2001), rating how much they used each strategy. The participants repeated the procedures 7 and 14 days after the initial session.

Participants demonstrated increased expertise with the task towards the later sessions: they were able to reach the destination rooms more quickly and indicate the direction of other rooms more accurately compared to the initial session. As expected, survey strategies were not used extensively until the third session. However, route strategies were used at a high rate during all three sessions. It appears that the participants required learning experience in the environment to augment their cognitive maps with survey information. As they began to use more survey strategies, their performance on the wayfinding task also improved. That is not to say that route strategies were abandoned for survey strategies; rather, it seems that the route strategies had been integrated into a more complex representation of the environment. The participants who did not show as much improvement on the wayfinding task in the later sessions were also the participants less likely to report having used survey strategies, indicating the importance of survey strategies in efficient wayfinding.

All of these studies examined strategies used by individuals while finding their way. It's clear that people who use survey strategies can find their way more easily than those who use route strategies. In most of the research described, the participants were familiar with their environment, affording the use of survey strategies. When an individual has little experience with an environment and becomes lost or disoriented, he or she cannot rely on survey strategies. Seeking information from another person may be the best strategy to find his or her way. To my knowledge there is no research on strategies people use when they are lost or disoriented.

*Sense of direction.* Sense of direction is a phrase used commonly in everyday life, especially at the lower end (e.g., “I have no sense of direction”). It is defined as a feeling of self efficacy regarding one’s ability to orient within an environment, typically an outside environment (Prestopnik & Roskos-Ewoldsen, 2000; Hegarty, Richardson, Montello, Lovelace, & Subbiah, 2002). Hegarty, et al., (2002) investigated the relation between self-reported sense of direction and the types of environmental information acquired while wayfinding. In this study, blindfolded participants were asked to point in the direction of known landmarks located both inside the room and outside the building. The landmarks within the room were visible by line of sight. Locations of these objects tended to be represented in an egocentric manner, which is associated with route knowledge. The landmarks outside of the building, which were not visible by line of sight tended to be represented in an allocentric manner, which is associated with survey knowledge. Sense of direction was positively related to the accuracy of participants’ direction estimates for both line-of-sight and out-of-sight spaces. However, sense of direction was more strongly correlated with performance in the out-of-sight environmental space compared to the immediate space, suggesting that sense of direction is more strongly related to survey knowledge than route knowledge.

In a second experiment (Hegarty, et. al., 2002) participants were led through complex pathways in an open field while blindfolded, forcing participants to create a cognitive map of the space solely through kinesthetic and vestibular cues. At the end of the path, they were asked to point in the direction of the path’s starting position. These participants had also been measured for their self reported sense of direction. Once again, direction accuracy was positively

correlated with sense of direction. Even limiting spatial information to that acquired through non-visual sensations, sense of direction predicted accuracy.

In a separate study, Hegarty, et. al. (2006) had participants taken twice on a complex path through two floors of a large UCSB campus building. During the first guided tour, the experimenters took care to note eight landmarks spaced at approximately equivalent intervals on the path. During the second tour the participants were stopped at each landmark, at which they indicated the direction and distance to two other landmarks not within sight. They were also asked to indicate the direction of the path's origin at the conclusion of the second tour. Even across two levels in a building interior environment, sense of direction was positively correlated with accuracy of direction estimates. However, sense of direction was not correlated with distance estimates. The researchers argued that directional estimates rely on allocentric representations of space. On the other hand, distance estimates are rooted in route knowledge, associated with an egocentric representation that is anchored in the travelers' experience of moving from one landmark to another.

Another study that shows this relation is one by Prestopnik and Roskos-Ewoldsen (2000). They investigated the relations among sense of direction, wayfinding strategy use, and environmental familiarity. Participants completed surveys of their sense of direction, the extent to which they typically rely on survey and route strategies, and familiarity with the environment used in the study. Then they completed a computer-based mental navigation task in which they read sets of directions using highly traveled, main roads and landmarks that were pilot tested as being prominent and recognizable. The participants imagined themselves travelling the

pathways described and then were asked to indicate the direction of the paths' origin. These responses were recorded for both accuracy and response time.

Participants with greater familiarity of the area, more use of survey strategies, and higher sense of direction made quicker and more accurate judgments than participants with less familiarity, less survey strategy use, and lower sense of direction. These results were as expected. However, the researchers wanted to know whether any of the variables mediated or interacted with the others to predict wayfinding performance. When controlling for sense of direction, the amount of variability explained by familiarity and survey strategy use was reduced to non-significance, indicating the importance of this self-reported measure in predicting wayfinding performance.

Yet another study investigated the relationship between sense of direction and wayfinding performance, this time using a real-world wayfinding task. Kato and Takeuchi (2003) had college women complete a measure of sense of direction and then perform a wayfinding task in an unfamiliar environment: a nearby neighborhood. Participants were individually led by an experimenter on a complex, circuitous pathway through the neighborhood. Immediately afterwards, the participants were asked to retrace the path on their own. While doing so, they said aloud what they were thinking. The experimenter followed along, recording the thoughts. These utterances were coded into three categories: 1) attempts to memorize a chronological series of turns (route information), 2) attempts to memorize a chronological series of landmarks (route information), and 3) attempts to update their position in the environment through either cardinal directions or directions of distal landmarks not attached to the immediate

environment (survey information). In addition to their thoughts, their wayfinding performance was recorded by counting the number of errors made at intersections.

For the analysis, participants were divided into two groups: those with good sense of direction (GSD) and those with poor sense of direction (PSD). The PSD group made many errors at intersections, while the GSD group made none. In terms of their thoughts, the GSD group's utterances showed that they used a greater number of strategies throughout the wayfinding task compared to the PSD group. Further, the GSD group was more likely than the PSD group to verbalize complex strategies utilizing cardinal directions or allocentric references to the relations between significant landmarks along the path. By using a large number of distinct strategies throughout the task, the GSD group displayed greater flexibility compared to the PSD group. Looking at the utterances over time, the GSD group frequently showed a pattern of using new strategies and integrating information throughout the task. The PSD group frequently used the same strategies over and over, long after they had proven less than useful, sometimes making the same utterances continually while growing more frustrated as the task continued.

To summarize, sense of direction is positively related to accuracy in wayfinding tasks, flexibility in types of strategies used, and survey knowledge. It also is related to gender, as is wayfinding performance, topics that are discussed next.

*Gender and wayfinding.* Females generally perform poorer on measures of wayfinding ability than males (Schmitz, 1999; Lawton & Kallai, 2002). Females also report having a worse sense of direction and using fewer survey strategies than males report (Hegarty, et al., 2006; McKeen & Roskos-Ewoldsen). For instance, in the Hegarty, et. al. (2006), article described in

the section on sense of direction, when the participants were asked to engage in the complex wayfinding task through the two floors of the building; it was noted that high sense of direction was related to better performance. Though this was true for both men and women, men typically reported having a higher sense of direction and performed better on the wayfinding task compared to women.

In another study that used a large complex building, Choi, McKillop, Ward, and L'Hirondelle (2006) had participants individually accompany an experimenter along a route including wings of a large complex arts building. Participants were then asked to lead the experimenter back to the route's origin by one of two methods. One group was asked to take the most direct pathway possible. The other group was told to backtrack through the same complex route they had been led through. The dependent variables were: 1) how much distance the participants covered (a ratio of how much they actually covered over the minimum distance possible), 2) how many incorrect choices or marked hesitations they made at intersections, and 3) when asked to provide written instructions of the route after completing the task, how many landmark based, distance based, and cardinal direction based comments were given. In the direct route condition, men led the researchers on significantly shorter routes compared to the women, indicating enhanced survey knowledge of the wayfinding environment. There were no sex differences in incorrect choices or marked hesitations in the direct route condition. In the backtracking condition there were no sex differences. However, women had a propensity for landmark based information in their route descriptions compared to men.

Several researchers have used similar methodologies to explore gender differences in wayfinding ability. For example, Schmitz (1999) asked participants to engage in a similar,

though simpler, wayfinding task: following a path on just one floor of a large academic building. Each participant was escorted along the route before being asked to retrace their steps. Wayfinding ability was assessed by timing each participant and counting the number of errors made at intersection points. Even without the added complexity of a multi-floor building, men tended to perform the task in less time and made fewer errors at intersections compared to women.

Researchers have also found gender differences in experimental designs using virtual environments. Chen, Chang, and Chang (2009) had college aged men and women explore a virtual environment built to resemble an underwater park. The park consisted of a series of rooms interconnected with tube shaped walkways. The walls and ceilings of the walkways and rooms were clear plastic so that while wandering through the virtual environment it was possible to see the surrounding water. All participants were given time to explore this environment two weeks before the actual experiment, giving them an opportunity to practice moving through the virtual space. Half of the participants were given egocentric navigational support while exploring the virtual spaces whereas the rest were given allocentric navigational support. Egocentric navigational support consisted of arrows arranged along the pathways indicating the route for the participants to follow. The allocentric navigational support consisted of a “you are here” map situated in the corner of the computer display, providing information on the participant’s position relative to the desired destination in the environment. The actual experiment consisted of two timed trials. The participants needed to find their way to a specific distant landmark located somewhere within the interconnected rooms. Participants also completed a measure of the extent to which they used different kinds of wayfinding strategies

(specifically route and survey strategies) while doing the wayfinding task. The results indicated that men found the landmark locations more quickly than women. In addition, men were more likely to prefer using survey (allocentric) strategies compared to the women. Regarding the manipulation, gender interacted with the type of support provided. For women, those who were provided with route (egocentric) navigational support found the destination more quickly compared to the women given the survey (allocentric) navigational support. For men there were no differences between the two conditions.

With converging findings supporting gender differences in sense of direction, wayfinding strategy use, and wayfinding ability, many researchers from both within and outside cognitive psychology became interested in understanding why they exist. Evolutionary theorists argued that females are historically given fewer opportunities to explore and develop survey orienteering skills throughout their development, rarely gaining the opportunities to attain and use survey information in their environment (Silverman et al., 2000). According to Silverman et al. (2000) in hunter/gatherer cultures, hunting duties are typically given to men whereas women take on food gathering responsibilities. Hunters have to move quickly over large expanses of land, spending most of their cognitive resources on searching and tracking, often going beyond the reach of familiar landmarks and requiring survey knowledge of the region to find their way home. Gatherers moved in ever expanding circles radiating from single locations, reinforcing the position of local landmarks as they moved repeatedly through the nearer groves first, then out towards the furthest orbits in search of food. Yet many researchers are uncomfortable with the assumption that the gender differences, measured in modern navigational experiments, are rooted in these early cultural travelling behaviors.

As an instance of researchers examining modern gender related variables in wayfinding, researchers in Taiwan investigated whether gender differences could be confounded by differences in occupational trends (Tang, Wu, & Lin, 2009). Of their 107 participants, 30 were tagged as coming from professions that could specifically increase specialized knowledge of buildings and emergency procedures (construction workers, emergency response personnel, etc.). All 30 of the tagged participants were men, and the rest of the participants were a combination of men and women. The researchers expected better wayfinding among participants whose professions required wayfinding skills compared to the other participants. All of the participants were timed as they attempted to navigate from a centrally located room to an emergency exit on an external wall. The researchers were surprised to find that their “professional” participants were no different than the other participants in the time it took to find the exits. However, women took 55% longer to navigate towards an exit compared to men. It would seem that something beyond specialization of profession contributes to these gender differences.

Lawton and Kallai (2002) studied self-reported exploratory behavior (in reference to behavior from childhood to adulthood) among participants from a major city in the United States and from a similarly sized city in Hungary. The participants in both countries completed surveys about their experiences with wayfinding behaviors (e.g., the distance they were allowed to travel from home on their own at various ages and by various means), sense of direction, the extent to which survey and route strategies are used while wayfinding, feelings of personal safety, and spatial anxiety. In the United States, women reported having fewer wayfinding experiences than men, but in Hungary there was no difference between women and men in their exploratory behavioral experience. Yet in both samples the women reported having a lower sense of

direction and using fewer survey strategies than men. Something beyond the extent of wayfinding experience was underlying the gender differences in sense of direction and the use of survey strategies. Lawton and Kallai looked to social/personality characteristics as a possible explanation for the gender differences.

### 3. SOCIAL/PERSONALITY ASPECTS OF WAYFINDING

One social/personality construct related to wayfinding is one's feeling of personal safety. Feelings of personal safety reflect how vulnerable people feel in their homes, workplaces, and points in between (Lawton and Kallai, 2002). Another construct related to wayfinding is spatial anxiety. Spatial anxiety involves how much fear one feels at the thought of not being able to find one's way in an environmental space (Lawton and Kallai, 2002). In Lawton's work, spatial anxiety is treated as a state characteristic that depends on the wayfinding situation.

*Feelings of personal safety.* Many disciplines investigate this construct including criminal justice (e.g., Møller, 2004), human geography (e.g., Koskela, 1999), and wayfinding researchers (e.g., Lawton and Kallai, 2002). Terminology for the construct varies across disciplines and includes feelings of personal safety, feelings of vulnerability, perceptions of personal safety, satisfaction with personal safety, and perceived threat. All of these terms refer to essentially the same construct.

As a general rule, women, the elderly, and minority groups typically report higher feelings of vulnerability than men, younger people, and majority groups (European Crime Prevention Network, 2004). This may be due in part to the researchers and decision makers having rarely acknowledged the views of those specific groups when designing spaces and the policies governing those spaces in the past. Many special interest groups and grass roots political movements have recently spurred greater interest on the part of policy makers in documenting these trends of perceived threat. For example, while Lawton and Kallai (2002)

documented gender differences in feelings of personal safety, The British Crime Survey went into greater specifics, documenting that women report greater fear than men about specific forms of victimization, especially being burglarized, mugged, physically attacked, racially attacked, and insulted or pestered (European Crime Prevention Network, 2004). As a result, a host of qualitative surveys have been designed by civil and private research groups attempting to measure individuals' feelings of safety in specific environments under the civil or private group's jurisdiction (e.g., The International Crime Victim Survey, The British Crime Survey). These surveys contain questions similar to those in Lawton and Kallai's (2002) Feelings of Personal Safety measure (e.g. "How safe do you feel alone after dark"), though they typically contain a greater number of questions as they go into more specific detail about criminal activities (e.g., "What would you say are the chances that over the next twelve months someone will try to break into your home?").

These perceptions of threat typically come from three places (European Crime Prevention Network, 2004): acknowledgement of dangerous elements in the environment that increase one's chance of becoming a victim; acknowledgement of personal characteristics that cause one to perceive themselves as physically or socially more likely to be victimized (i.e., member of a disadvantaged group); and acknowledgement of feelings of low social control - the idea that what happens to an individual in an environment is beyond that person's influence. Some have argued that this attitude of neglect towards specific populations has engendered excessive perceptions of threat among those who feel vulnerable even though they are living in safer than average neighborhoods. Someone expecting their complaints to be ignored or minimized by the authorities may perceive themselves as being in more danger of being victimized than they

actually are. At the same time, a reluctance to acknowledge real threats increases the likelihood of being victimized (e.g., not being careful of pick-pockets, leaving expensive items visible in a parked car).

Møller (2004) used the survey responses collected by the Institute for Security Studies, a component of the Nelson Mandela Metropolitan Municipality crime prevention movement, to illustrate how perceived threat and feelings of personal safety significantly impacted reports on quality of life. The institute's surveys included likert scale questions about respondents' perceptions of how likely they could be the victim of some form of crime to the household (e.g., burglary, destruction of property, murder) and to the individual (e.g., assault, sexual assault, robbing). Additionally, the surveys asked for the participants to indicate their levels of overall satisfaction concerning their lifestyle (e.g., personal safety, housing, public transport).

The results showed that high likelihood of being the victim of crime towards the household was negatively correlated with satisfaction over feelings of safety, but only for the white respondents. For the black respondents, high likelihood of being the victim of crime towards the individual was negatively correlated with satisfaction over feelings of safety. These findings highlight the impact of economic, cultural, and demographic factors on feelings of safety. In general, the white South African respondents had higher socio-economic status than the black South African respondents. This position would cause them to perceive themselves as likely targets of burglary. Black South African respondents typically had lower socio-economic status and lived in rough areas, and perceived themselves as likely targets of physical attack. Though the perceived crimes came in different forms, for both groups it was related to low

scores on their satisfaction with personal safety. Though not directly related to wayfinding these results suggest that feelings of safety are tied to more than the environment itself.

Perceptions of personal safety have also been studied by human geographers. Geographical research has supported the relation of perceived environmental threat and feelings of personal safety (Pain, 1997; Koskela, 1999; Wesley & Gaarder, 2004). Quantitative measures are typically used to collect ratings of fear while travelling through various spaces to help geographers map out the areas associated with the highest perceived vulnerability, followed up in the same studies by qualitative, open-ended interviews either in person or over the phone.

The quantitative surveys, typically administered by mail, indicated increased wariness overall among women compared to men, especially while traveling through poorly lit and/or low traffic flow areas (Koskela, 1999). The questions lay out activities and situations as varied as travelling to work in the morning, to running out to the store for some necessity in the later evening. As expected, many women reported low traffic flow areas as being dangerous. Some high flow traffic areas were reported as dangerous places by women as well. The qualitative interviews fleshed out that this was especially true for public transportation, in that being on a train or bus and in close contact with others limited the perceived control over what could happen to them. Perceived control is related to feelings of danger and discomfort because a lack of perceived control would suggest that one is incapable of controlling what kind of experience (positive or negative) one will have while navigating through an environment. Rather, the potentially abusive actions of others will dictate the nature of the experience.

The qualitative interviews revealed detail about the thought processes, experiences, and compensatory strategies related to these negative feelings. First or second hand experiences

ranging from sexual harassment (cat calling, frotteurism, indecent exposure) to total sexual assault or other violent crimes, create boundaries of acceptable locations and places where women felt that their safety was in jeopardy (Pain, 1997). The interviews also revealed that women feel discomfort in areas that are too dark, too wooded, or sparsely populated while additionally stating that they perceive men feeling that those locations are still accessible to them (Koskela, 1999). Women frequently have to prepare for outdoor travel activities with a variety of compensatory strategies such as taking a dog, going in groups, going with a male friend, modifying their routes or their time of travel, investigating potential safety features of a space (i.e., emergency phones, security guards, surveillance cameras) or even changing their clothing to garner less attention (Wesley & Gaarder, 2004).

These studies indicate that feelings of personal safety and the perception of threat in one's environment affect one's attitudes towards travel, such as what one feels one is capable of doing and what activities one feels comfortable engaging in. In addition, feeling vulnerable to criminal activity decreases overall environmental satisfaction (Pain, 1997). The condition of the environment one is in plays a significant role in one's feelings of personal safety, but how is it related to spatial anxiety and/or the social interactions one may have in that environment?

*Spatial anxiety.* Early on, Lawton (1996) argued that heightened spatial anxiety, whether related to personal safety or not, consumes cognitive resources and negatively influences one's ability to attend to global aspects of the surrounding environment. In turn, this state limits the use of effective survey strategies and increases the likelihood of becoming lost or disoriented (Lawton, 1996). In the Lawton and Kallai (2002) study that compared men and women in the US and Hungary, they found evidence consistent with that interpretation. In the study, they

included questions regarding spatial anxiety and feelings of personal safety to investigate the pattern of gender differences across these constructs as well as the use of survey strategies (reported earlier). Their Spatial Anxiety scale listed tasks that might cause the respondent anxiety in a wayfinding situation (e.g., “Finding your way back to a familiar area after realizing you have made a wrong turn and become lost while driving”). Participants indicated their anxiety on a likert scale. The Feelings of Personal Safety measure listed tasks that might cause the reader to feel unsafe in a wayfinding situation (e.g., “Walking alone in my neighborhood at night”). Participants used a likert scale to indicate how safe they would feel doing the tasks. The women in both the United States and Hungary both reported higher feelings of spatial anxiety and lower feelings of personal safety compared to the men. As reported earlier, women from both countries also reported using fewer survey strategies than men. Though not an experimental study, Lawton and Kallai (2002) argued that women used fewer strategies than men because they had higher levels of spatial anxiety and lower levels of personal safety, both of which reduce cognitive resources.

McKeen and Roskos-Ewoldsen (2007) followed up on these ideas by including a wayfinding performance measure. In this study, participants filled out a battery of questionnaires, including the surveys used by Lawton and Kallai (2002). A subset of these participants also took part in a computerized measure of wayfinding ability that involved learning and accurately following a route through a virtual environment (i.e., photographs of a series of intersections in a neighborhood) to “locate one’s car” (McKeen & Roskos-Ewoldsen, 2007). Wayfinding performance was measured by the number of trials it took participants to learn the route to 100% accuracy and the total amount of time it took them to reach criterion.

As in the Lawton and Kallai studies, it was found that women reported lower feelings of personal safety, higher spatial anxiety, less survey strategy use, and lower sense of direction than men. Further, lower feelings of personal safety and higher spatial anxiety were each associated with less survey strategy use and poorer sense of direction. Interestingly, these latter findings were the same for both men and women. Finally, as expected, men learned the route more quickly than women; however, men and women did not differ on the number of trials to criterion. Apparently, women spent more time traveling the route than men.

Neither spatial anxiety nor feelings of personal safety predicted wayfinding performance and neither interacted with gender to predict wayfinding performance. Therefore, although these social/personality characteristics may be related to sense of direction and to the types of strategies one uses, they do not appear to predict wayfinding performance, at least as measured with a computer simulation. If they are not related to wayfinding performance (at least in a route learning task), are they related to other aspects of wayfinding behavior? To answer this question, first one must better understand the construct of spatial anxiety.

*General and spatial anxiety.* In Lawton's work, spatial anxiety is treated as a state characteristic that depends on the wayfinding situation. However, there has been no research on this question or on the larger question of how spatial anxiety is related to general anxiety. Perhaps individuals high in general anxiety are likely to feel anxious when presented with any task, including the ones related to wayfinding, and using the construct of spatial anxiety is unnecessarily specific.

General anxiety is typically seen as a stable personality trait, measurable through the neuroticism factor of the big five model of personality (Rice & Markey, 2008). Neuroticism is a

broad construct of which general anxiety is an important component. Neuroticism is also sometimes called “negative emotionality,” depicting people’s tendencies towards anxious feelings, self-consciousness, and vulnerability to stress (Cox, Borger, Taylor, Fuentes, & Ross, 1999). Cox, et al. argue that Neuroticism acts as an overarching, higher-order trait, potentially contributing to, yet still distinct from, surface traits that relate to negative emotions in specific contexts; such as math anxiety and test anxiety. It could be that spatial anxiety is a surface trait comprising context specific negative emotional tendencies when navigating or thinking about navigating in environmental spaces. To my knowledge, no one has addressed this question.

Just as women tend to report higher levels of spatial anxiety than men, they also typically report higher levels of general anxiety than men. Social theorists assert this could come from men under reporting anxiety levels because the social roles taught to males emphasizing strength, independence, bravery, and problem-solving acuity. Support for this idea comes in the form of masculinity ratings being negatively correlated with anxiety ratings for both men and women (McLean & Hope, 2010). Cognitive theorists point out that these social roles could create thought processes more conducive to higher anxiety ratings from women. Young women are not taught to value their problem-solving acuity as much as young men; they may come to question their self-efficacy (McLean & Anderson, 2009). Young women are also taught through social roles to emphasize emotional understanding. Low self-efficacy and a potential propensity for rumination of negative emotional experiences would predict higher anxiety levels.

If spatial anxiety is a trait characteristic, there are three possible relations between general anxiety and spatial anxiety. The first is that spatial anxiety is completely encapsulated by general anxiety, the two sharing a nearly perfect correlation. Measuring spatial anxiety as

opposed to general anxiety garners no additional information. The second is that spatial anxiety and general anxiety measure both overlapping and separate traits. In this case, the most likely scenario is that spatial anxiety is specific to wayfinding, just as math anxiety is specific to math. This would present a moderate to strong correlation between spatial anxiety and general anxiety. This would also mean that measuring spatial anxiety would have value beyond measuring general anxiety. The third possibility is that spatial anxiety and general anxiety measure completely separate variables and have a near zero correlation. This would mean that general anxiety and spatial anxiety are not interchangeable at all. In any case, the relation between general and spatial anxiety is unclear and needs to be investigated.

#### 4. SOCIAL ASPECTS OF WAYFINDING

There is very little research on how the environment plays a role in direction-seeking behavior. Fortunately, one can rely on the research by social psychologists that investigate the constructs of comfort and help. Comfort is distinct from help. It is characterized as making someone feel better by one's presence, oftentimes without providing aid on a specific task. The circumstances under which a person seeks comfort, and from whom, is investigated by affiliation researchers. In contrast, helping or seeking help are typically task-specific. Like the affiliation researchers, researchers investigating helping or help-seeking behavior often study the circumstances under which a person helps or seeks help.

*Affiliation.* Firestone, Kaplan and Russell (1973) conducted a study on affiliation where participants thought they were in an experiment on pain thresholds. In the experimental condition they were told that they would be receiving painful shocks. In the control condition the participants were told they would be experiencing pleasurable electrical stimulation. The participants were told that the shocking machines were being calibrated, and were offered two options while waiting. They could wait with participants who were also going to be receiving shocks, or they could wait with participants who were waiting to be run in a different study down the hall, one that did not involve receiving shocks. The participants who thought they were going to be receiving painful shocks chose to wait with the participants who would also be receiving shocks. Participants who thought they were going to be receiving pleasurable shocks

showed no preference. This result was interpreted to show that people who are feeling fear or threat generally prefer to be with others who share the same feelings.

Research into gender and affiliation has shown how seeking empathy frequently occurs in times of stress and anxiety. Generally females seek out affiliation for the purposes of social support and kindness (Doss & Christensen, 2006). Researchers argue that these tendencies are so strong in times of peril that, rather than characterizing female responses to danger as “fight or flight,” they should be characterized as “tend and befriend.” The argument is that it is more adaptive for females (and the young that they attempt to protect) to build protective kinship circles in the face of danger, rather than risk injury or offspring abandonment through a fight or flight reaction (Taylor et al., 2000; Taylor et al., 2002). Males seek out affiliation for achievement success, whether that means hunting as a group or adding powerful names to your proposed business model in hopes of getting a generous loan (Rudman, Greenwald, & McGhee, 2001). This takes us back to the idea of seeking aid in the form of cooperative behavior aimed at specific tasks, like asking for directions.

*Helping and help-seeking.* Social psychologists’ research into helping and help seeking behavior has repeatedly demonstrated that group membership (in-group, out-group) and feelings of empathy play critical roles in predicting cooperative behavior (Sturmer, Snyder, Kropp, & Siem, 2006). For example, German and Muslim students at a university in Germany listened to another individual’s problem in an online interaction. The other individual was actually a confederate; information about the confederate’s ethnicity was provided only by the name used when introducing himself to the participant: either Markus or Mohammed. After this interaction, participants completed a variety of surveys about their feelings of sadness and distress at having

read the confederate's plight. The surveys measured interpersonal oneness and perceived traits of the confederate.

Participants showed increased intentions to help another individual (the confederate), and feelings of empathy towards the confederate and a higher level of perceived shared characteristics, as long as the confederate was presented as coming from the same cultural group as themselves. The participants reported feeling less sad, less empathy, a lower level of perceived shared characteristics, and lowered intentions to help when the confederate was presented as coming from the different cultural group. It appears that people are more willing to help someone with a personal problem when the person is from an in-group compared to a person from an out-group (Sturmer, Snyder, Kropp, & Siem, 2006).

Sometimes being a member of an out-group can *increase* the likelihood of helping. In a study by Pearce (1980), two female confederates (one Australian and one American) and two male confederates (also Australian and American) worked with a researcher who traveled with American travelers in Greyhound buses all over the continental United States. At the terminals the confederate travelers asked for help from passengers riding on the same bus as the researcher. Sometimes the confederates had also been traveling on the same bus as the researcher and sometimes they had not, creating two conditions: familiar and unfamiliar to the passengers. The confederates asked questions about the locations of vending machines, restrooms, post offices, or the time. The researcher had expected that the confederates who were familiar to the passengers would have a higher likelihood of being helped than those who were not familiar. This was not the case. The most impressive results had to do with gender and nationality. All confederates but the American male were likely to receive helpful information from the travelers. Apparently

it was more acceptable for women (both Australian and American) and for male Australians, being “foreign tourists,” to be seeking help.

From the perspective of the person seeking help, he or she is more likely to ask for help from a member of an out-group when the task is central to one’s self image. In a study by Nadler (1987), students in Tel Aviv attempted to solve an anagram puzzle. In one condition the participants were told that puzzle performance was highly correlated with intelligence, a trait arguably central to one’s self concept, and in the other they were told the puzzles were just fun games related more to things like mood and luck than anything else. In addition, the participants were assessed beforehand, by survey, regarding their level of self esteem. While working on the anagrams the participants were told they could fill out a form requesting helpful hints from other participants. The other participants were briefly described as either another man or woman participating in the experiment. The participants offered help from an in-group person were told the other participant was of the same sex, while the participants offered help from an out-group person were told the other participant was of the opposite sex. Participants with high self esteem who were told performance was related to intelligence showed an out-group preference, a preference for seeking help from a person of the opposite sex. Other participants—those who were either lower in self esteem and/or were told that puzzle performance was related to luck—showed no out-group preference for seeking help from others. They were equally likely to ask for help from in-group and out-group members. These results indicate that help seeking behavior is related to “saving face.” Those with high self esteem, put in a situation that threatens their self esteem, prefer to ask for help from an out-group member, which preserves their esteem amongst people of their in-group.

The studies on asking for or receiving assistance shed light on the results of a recent study on the likelihood of asking for or giving directions in a wayfinding situation. In the McKeen and Roskos-Ewoldsen (2007) study, participants indicated in a survey how likely they were to ask for or give directions in different situations. In particular, participants indicated their level of agreement with statements such as “During the day, I am comfortable asking for directions from strangers,” and “During the day, I am comfortable giving directions to strangers.” These statements were collapsed into two separate variables: likelihood of asking directions and likelihood of giving directions. The results showed that men were more likely than women to give directions, as expected, but men were also more likely to ask for directions. The finding that men were more likely than women to ask for directions was unexpected and contrary to anecdotal stereotypes about men and women and direction giving/seeking behavior. It was expected that participants with lower anxiety and higher sense of direction (typically men) would be more likely to give directions because of their perceived competence, but less likely to ask for directions because they would consider asking for directions unnecessary. In contrast, it was expected that participants with higher anxiety and lower sense of direction (typically women) would be more likely to ask for directions and less likely to give directions.

Perhaps the use of the term *stranger* introduced an unexpected in-group/out-group comparison. Men who are put in a situation that threatens their self perceived sense of direction, a wayfinding situation in which they are lost, may be willing to ask a stranger for directions because the stranger is a member of the out-group. Women who are put in the same situation may be less likely to ask for directions from an out-group member because of their higher levels

of anxiety. The literature on comfort seeking supports this idea. The question of in-group/out-group behavior is addressed in experiment 2 of the current project.

It is unclear how closely self-report measures of asking for directions predict these behaviors in real life. In fact, there is little known about the strategies people use to find their way when they are lost. Do they ask someone nearby, or do they call someone, or use a GPS?

## 5. OVERVIEW OF STUDIES

Combining the literatures on wayfinding, wayfinding strategies, sense of direction, social/personality variables, social affiliation, and helping behavior, this project addresses three primary questions. Experiment 1 investigates the factors that may be related to one's perception of threat in an environment. Additionally, it addresses the relation between spatial and general anxiety. The second question, investigated in experiment 2, is whether anxiety and perceived environmental threat predict the likelihood of asking someone for help in a wayfinding situation. The last question, investigated in experiment 3, addresses the strategies people use to find their way when they are lost in an environment.

## 6. EXPERIMENT 1 PERCEIVED THREAT

Anecdotal lore suggests that almost everyone will be at least a little threatened when the environment seems unsafe or otherwise scary. However, people who have a poor sense of direction, finding themselves in such an environment, may have an added worry in that they perceive themselves as having difficulty wayfinding out of any environment, let alone one that is perceived as threatening. In particular, people who know they have difficulty finding their way and who feel anxious about that, may perceive an amplified amount of threat by being in a threatening environment, compared to being in a non-threatening environment. On the contrary, people who know they can wayfind easily and are not as anxious, may perceive less danger in a threatening environment than those with a low sense of direction and higher anxiety. The main emphasis of experiment 1 was on the factors that may predict perceived threat in an environment. More specifically, do the variables sense of direction, spatial and general anxiety, level of threat described in an environment, and gender predict perceived threat? Participants were measured on their sense of direction before reading two wayfinding vignettes, one in which they imagined that they were walking and in the other they were driving through an environment. In one condition, both the walking and driving vignettes described an environment that was threatening. In the other condition, both were described as non-threatening. After reading the vignettes, participants completed measures of spatial and general anxiety and a measure of perceived threat in the vignette environments.

## 7. EXPERIMENT 1 METHODS

*Design.* The design was mixed, with sense of direction, spatial anxiety, and general anxiety serving as continuous independent variables, and described environment (threatening, non-threatening) and gender as between-subjects independent variables. Gender is used as an independent variable throughout the analyses of this document as gender differences are prevalent in the wayfinding literature. The dependent variable was perceived threat.

*Participants.* To determine the number of participants to be recruited, a power analysis was conducted. Although there is no extant literature on the role of sense of direction and anxiety on threat, the relation between sense of direction and spatial anxiety tends to be moderate in size,  $r = -.28$  (McKeen & Roskos-Ewoldsen, 2007). An a priori power analysis suggested around 103 participants, expecting a moderate effect size,  $f^2 = .11$ , power = .80, and alpha = .05 (Faul, & Erdfelder, 1992). Therefore, data from 102 participants were collected, with each condition containing 51 participants (threatening: 26 male, 25 female; non-threatening: 12 male, 39 female). The participants were recruited from the research participant pool in the Psychology Department at The University of Alabama, representing students enrolled in Psychology 101. They were given credit toward fulfilling a course requirement.

*Measures.* This experiment used four measures and two described environments. The measures included a demographics form asking about the participant's gender, age, and ethnicity (Appendix A), the Santa Barbara Sense of Direction scale (Appendix B), the Spatial Anxiety scale with additional items from the neuroticism arm of a five factor model of personality that

measures general anxiety (Appendix C), and an assessment of how threatening the vignettes seemed to be (Appendix D). The described environments comprised two sets of vignettes, one set describing potentially threatening environments and the other set describing non-threatening environments (Appendix E).

The Santa Barbara Sense of Direction Scale (Hegarty, Richardson, Montello, Lovelace, & Subbiah, 2002) is a fifteen-item instrument developed specifically to measure a respondent's self reported sense of direction (Appendix B). Statements include "I am very good at reading maps" and "It's not important to me to know where I am." For each statement the participant uses a likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), indicating the extent to which they agree that these statements apply to themselves. Negative statements, such as the second example listed, are reverse coded and higher summed scores indicate a higher sense of direction. The test-retest reliability from Hegarty et al. (2002) was .91.

The Spatial Anxiety Scale (Lawton, 1994) has nine items representing various spatially-related situations (Appendix C). For each item, participants indicate how much anxiety they would feel on a scale ranging from 1 (*not at all*) to 7 (*very much*). It presents the participant with situations such as "Finding your way around in an unfamiliar mall," and "Finding your way to an appointment in an area of a city or town with which you are not familiar". The ninth item, "Using maps to find your way," was added by me, as it directly related to topics of interest in my research endeavors. Lawton (1994) showed that the Cronbach alpha for this scale is .80. McKeen and Roskos-Ewoldsen (2007) found similar reliability properties, with a Cronbach alpha of .78.

To afford testing the independence of spatial and general trait anxiety, the eight questions from the neuroticism subscale of the big five measure of personality (Benet-Martinez & John, 1998), were added to the Spatial Anxiety Scale (Appendix C). Benet-Martinez and John (1998) showed that the Cronbach alpha for the Neuroticism subscale is .83.

For the dependent variable, after having read both vignettes (i.e., walking, driving), participants rated each vignette on a 1 (*not at all threatening*) to 7 (*extremely threatening*) scale (Appendix D). The vignettes were written specifically for the purposes of this project (Appendix E). One set described attempting to wayfind late at night in a desolate and dangerous environment. The other set described a casual afternoon setting. Within each set of vignettes, one vignette described a wayfinding experience while driving and the other while walking. These vignettes were piloted beforehand to determine that they were significantly different in degree of perceived threat. Ratings from 20 participants (10 female, 10 male), using a scale ranging from 1 (*not at all threatening*) to 7 (*extremely threatening*), showed that this was the case for the walking vignettes, (threatening,  $M = 4.30$ ,  $SD = 1.49$ ; non-threatening,  $M = 2.50$ ,  $SD = 1.90$ ),  $t(18) = -2.36$ ,  $p < .05$ . Ratings from another 20 participants (10 female, 10 male) showed this was the case for the driving vignettes as well, (threatening,  $M = 4.90$ ,  $SD = 1.20$ ; non-threatening,  $M = 2.50$ ,  $SD = 1.35$ ),  $t(18) = -4.20$ ,  $p < .005$ . Actually, the threatening condition was only moderately threatening, but I am going to use the term threatening for ease of comprehension.

*Procedures.* This study was designed so that all of the data collection was done online through the University of Alabama's subject pool website, which contains its own questionnaire builder. The two vignette conditions were presented on the subject pool website as two different

studies. In addition, having participated in one of the conditions caused one to become ineligible to participate in the other, as this project was a between subjects experimental design.

As participants signed up for the online survey research, they were first asked to read over their rights as a participant. The completion of the surveys was regarded as giving consent. After that, every participant was asked to complete the demographics questionnaire and then the Sense of Direction Scale. Next, participants read the two vignettes, and then completed the Spatial Anxiety Scale. Then they completed the manipulation check, after which each participant was presented with a message thanking them for their participation and giving them a short debriefing as to the purposes of the study. The study lasted around 30 minutes.

## 8. EXPERIMENT 1 RESULTS

First, the variables were checked for normalcy and reliability. Normalcy was checked by looking at the variables plotted as histograms and reporting the skewness and kurtosis (Table 1). All variables used in Experiment 1 were deemed to be normally distributed. In addition, the scales had acceptable internal reliability: The Cronbach alphas were .89 (Sense of Direction); .77 (Spatial Anxiety); and .80 (General Anxiety).

*Factors predicting perceived threat.* First, correlations among all the variables were calculated (Table 2) except for gender, as gender differences will be discussed with a separate table. Notably, general anxiety was positively correlated with perceived threat in the driving environment ( $r = .50$ ). The more anxious the participants reported being, the higher their perceived threat in the driving vignette. In addition, the described environment was correlated with perceived threat, but only in the walking environment ( $r = .41$ ). In the walking environment, perceived threat was higher in the threatening than the non-threatening environment. Also, sense of direction was negatively correlated with general anxiety ( $r = -.36$ ). The higher the participant's self reported sense of direction, the lower their reported general anxiety. Secondary correlations included a moderate positive correlation between spatial and general anxiety ( $r = .19$ ), and an anomalous correlation between sense of direction and the described environment ( $r = .27$ ), with sense of direction being higher in the threatening environment than in the non-threatening environment. It is not surprising that there was a positive correlation between spatial and general anxiety because they are both measuring

Table 1

*Descriptive Statistics for All Variables*

Variable	Minimum (out of 1)	Maximum (out of 7)	Mean	SD	Skewness	Kurtosis
Experiment 1						
Sense of Direction	1.47	6.53	4.22	1.12	-0.14	-0.41
Spatial Anxiety	1.33	6.44	3.70	1.00	-0.11	0.42
General Anxiety	1.00	6.38	3.62	1.01	0.24	0.23
Perceived Threat W	1.00	7.00	4.21	1.70	-0.11	-0.75
Perceived Threat D	1.00	7.00	3.91	1.48	-0.25	-0.77
Experiment 2						
Spatial Anxiety	1.33	6.78	3.45	1.04	0.37	0.80
General Anxiety	1.63	6.25	3.68	1.02	0.22	-0.12
Perceived Threat W	1.00	7.00	4.80	1.71	-0.43	-0.62
Perceived Threat D	1.00	7.00	4.42	1.58	-0.16	-0.65
Asking Strangers	1.00	7.00	3.99	1.28	-0.22	-0.14
Asking Familiar	3.67	7.00	6.51	0.83	-1.81	2.38
Giving Strangers	1.67	7.00	4.31	1.27	-0.19	-0.45
Giving Familiar	2.00	7.00	6.14	1.17	-1.64	2.42

Note: Perceived Threat W refers to the perceived threat of the walking vignettes.

Perceived Threat D refers to the perceived threat of the driving vignettes.

Table 2

*Correlations Among the Variables of Experiment 1*

	Spatial Anxiety	General Anxiety	Described Environment	Perceived Threat W	Perceived Threat D
Sense of Direction	-0.14	-0.39**	0.27*	-0.15	-0.15
Spatial Anxiety		0.19*	-0.07	0.10	0.13
General Anxiety			-0.06	0.09	0.50**
Described Environment				0.41**	-0.01
Perceived Threat W					0.23*

\*  $p \leq .05$

\*\* $p < .001$

Note: Perceived Threat W refers to the threat reported for the walking vignette.

Perceived Threat D refers to the threat reported for the driving vignette.

anxiety. It is unclear why sense of direction would be higher in one described environment than the other because participants were presumably randomly signing up for one condition or the other.

For the main analyses, two regression analyses were conducted, one for perceived threat in the walking environment and the other for perceived threat in the driving environment. In both analyses, sense of direction, spatial and general anxiety, described environment, and gender were the predictor variables. In addition, the interactions of sense of direction and all other variables, the interactions of described environment and all other variables, and the interactions of gender and all other variables were included in a hierarchical linear regression. These interactions were included to measure if anxiety (spatial and general) differed in ability to predict perceived threat based on one's sense of direction, gender, or the type of described environment (threatening vs. non-threatening) one received. Table 3 presents the results of these analyses for the walking environment. Table 4 presents the results of these analyses for the driving

Table 3

*Regression Analysis of Sense of Direction, Spatial and General Anxiety, Described Environment, and Gender Predicting Perceived Threat with the Walking Vignette*

Model	R <sup>2</sup>	Adj. R <sup>2</sup>	Std. Error	$\Delta R^2$	$\Delta F$
1	.38	.34	1.37	.38	11.57**
2	.44	.35	1.36	.07	1.17

	Unstandardized Coefficients		Standardized Coefficients	t value	Correlations	
	B	Std. Error	Beta		Partial	Part
Model 1						
Constant	2.04	.52				
Sense of Direction	-.35	.14	-.23	-2.51*	-.25	-.20
Spatial Anxiety	.14	.14	.08	1.02	.10	.08
General Anxiety	-.15	.15	-.09	-.98	-.10	-.08
Described Env.	.99	.15	.58	6.75**	.57	.54
Gender	1.33	.31	.38	4.34**	.41	.35
Model 2						
Constant	2.39	.55				
Sense of Direction	-.69	.58	-.46	-1.19	-.13	-.10
Spatial Anxiety	.29	.66	.17	.44	.05	.04
General Anxiety	.20	.64	.12	.31	.03	.02
Described Env.	.65	.55	.38	1.18	.13	.09
Gender	1.20	.31	.34	3.84**	.38	.31
SOD X SA	-.11	.13	-.09	-.85	-.09	-.07
SOD X GA	.21	.12	.18	1.82	.19	.15
SOD X Desc. Env.	.10	.15	.06	.65	.07	.05
Desc. Env. X SA	.18	.16	.11	1.12	.12	.09
Desc. Env. X GA	.05	.17	.03	.28	.03	.02
Gender X SOD	.20	.35	.22	.58	.06	.05
Gender X SA	-.09	.37	-.08	-.23	-.02	-.02
Gender X GA	-.18	.37	-.18	-.48	-.05	-.04
Gender X Des. Env.	.22	.32	.22	.68	.07	.06

Dependent Variable: Perceived Threat with the Walking Vignette

\* $p < .05$ , \*\* $p < .001$

Table 4

*Regression Analysis of Sense of Direction, Spatial and General Anxiety, Described Environment, and Gender Predicting Perceived Threat with the Driving Vignette*

Model	R <sup>2</sup>	Adj. R <sup>2</sup>	Std. Error	$\Delta R^2$	$\Delta F$
1	.26	.22	1.31	.26	6.80**
2	.34	.23	1.30	.07	1.07

	Unstandardized Coefficients		Standardized Coefficients	t value	Correlations	
	B	Std. Error	Beta		Partial	Part
Model 1						
Constant	3.56	.49				
Sense of Direction	.07	.13	.06	.57	.06	.05
Spatial Anxiety	.05	.13	.03	.38	.04	.03
General Anxiety	.74	.14	.50	5.10**	.46	.45
Described Env.	.04	.14	.03	.31	.03	.03
Gender	.21	.29	.07	.73	.08	.06
Model 2						
Constant	3.57	.52				
Sense of Direction	.71	.56	.54	1.28	.14	.11
Spatial Anxiety	-.49	.63	-.33	-.78	-.08	-.07
General Anxiety	1.37	.62	.93	2.23*	.23	.20
Described Env.	.53	.52	.36	1.00	.11	.09
Gender	.21	.30	.07	.70	.08	.06
SOD X SA	-.004	.13	-.004	-.04	-.004	-.003
SOD X GA	.08	.11	.08	.74	.08	.06
SOD X Desc. Env.	-.07	.15	-.05	-.50	-.05	-.04
Desc. Env. X SA	-.06	.15	-.04	-.41	-.04	-.04
Desc. Env. X GA	.18	.16	.12	1.12	.12	.10
Gender X SOD	-.40	.33	-.51	-1.21	-.13	-.11
Gender X SA	.39	.36	.44	1.08	.12	.09
Gender X GA	-.39	.35	-.45	-1.09	-.12	-.10
Gender X Des. Env.	-.30	.31	-.34	-.97	-.10	-.09

Dependent Variable: Perceived Threat with the Driving Vignette

\*p < .05, \*\*p < .001

environment. For the walking environment, sense of direction, described environment, and gender were the predictors of perceived threat,  $F(5, 96) = 11.57, p < .001, \text{adj. } R^2 = .34$ . The greater the participant's reported sense of direction, the lower their perceived threat. The threatening description of the walking environment induced a higher perceived threat than the non-threatening description. Women perceived more threat from the walking environment than men. None of the interactions added significantly to the model,  $\Delta F(9, 87) = 1.17, p > .05, \Delta R^2 = .07$ . For the driving environment, general anxiety was the only predictor of perceived threat,  $F(5, 96) = 6.80, p < .001, \text{adj. } R^2 = .22$ . The more anxious an individual the more threat perceived in the driving environment. None of the interactions added significantly to the model,  $\Delta F(9, 87) = 1.07, p > .05, \Delta R^2 = .07$ .

*Spatial anxiety and general anxiety.* The next analyses addressed the nature of the relation between spatial and general anxiety: are they independent, correlated but separable, or identical measures? Both exploratory and confirmatory factor analyses were used to address this question. Because the same questionnaire including the spatial anxiety and general anxiety questions was used in both experiment 1 and experiment 2, there was an opportunity to investigate the relations between these two constructs by combining the data from both the first and second experiments. This brings up the concern that the experiment itself could have an effect on the participants' anxiety measures. Experiment 1 and experiment 2 both had rigid orders to the measures given to the participants. In Experiment 1 all of the anxiety measurements were done after reading the vignettes, but in experiment 2 the anxiety measurements were done before the vignettes. To ensure that this was not a significant concern two ANOVA's were run predicting spatial and general anxiety by experiment, gender, and their

interaction. For spatial anxiety neither the main effects nor the interaction were significant  $F(3,200) = 1.77, p = .16$ . For general anxiety the main effect of experiment and the interaction were not significant  $F(3,200) = 2.64, p = .05$ , but the main effect of gender was  $F(1,200) = 4.30, p = .04$  (males  $M = 3.45, SD = .12$ ; females  $M = 3.76, SD = .09$ ). Given these results it was decided to continue with the spatial and general anxiety analyses using the combined data from experiments 1 and 2.

An exploratory factor analysis was conducted first to investigate the possibility that there were more than two factors involved. As shown in Table 5, there were five components with an Eigenvalue over one, three of which were moderate, explaining less than ten percent of the total variance. The variance accounted for by the factors with Eigenvalues between 1.00 and 2.00 was

Table 5

*Spatial Anxiety vs. Trait Anxiety: Eigenvalues and Variance Explained by Components*

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	4.435	26.088	26.088
2	2.620	15.409	41.497
3	1.223	7.196	48.693
4	1.051	6.185	54.878
5	1.016	5.975	60.853
6	.894	5.258	66.111
7	.819	4.820	70.931
8	.710	4.175	75.106
9	.641	3.768	78.874
10	.601	3.538	82.411
11	.551	3.240	85.651
12	.510	3.001	88.652
13	.446	2.626	91.278
14	.427	2.514	93.793
15	.397	2.337	96.130
16	.346	2.035	98.164
17	.312	1.836	100.000

Extraction Method: Principal Component Analysis.

comparable to the variability of factors with Eigenvalues less than 1.00. In contrast, the first two components had Eigenvalues over 2.0, and both explained a large amount of the variance (26% and 15% respectively) compared to the lower Eigenvalue components. Also, the scree plot (Figure 1) shows a leveling off in a plateau after two factors. Table 6 illustrates how the items loaded on the two factors. There was a clear division between the Spatial Anxiety questions and the big five Neuroticism questions (aka general anxiety), supporting the separateness of these two constructs. Also, the simple bivariate correlation between average ratings on the spatial anxiety scale and average ratings on the general anxiety scale was just barely significant  $r(101) = .19, p = .053$ .

Figure 1

*Spatial Anxiety vs. Trait Anxiety: Scree Plot*

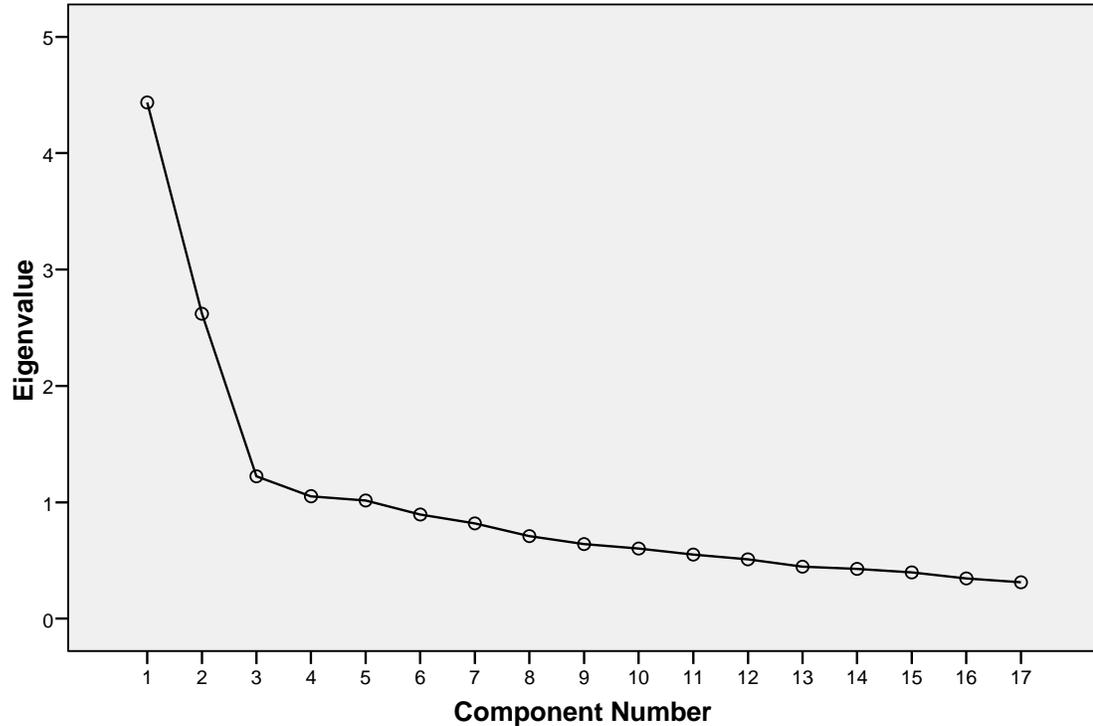


Table 6

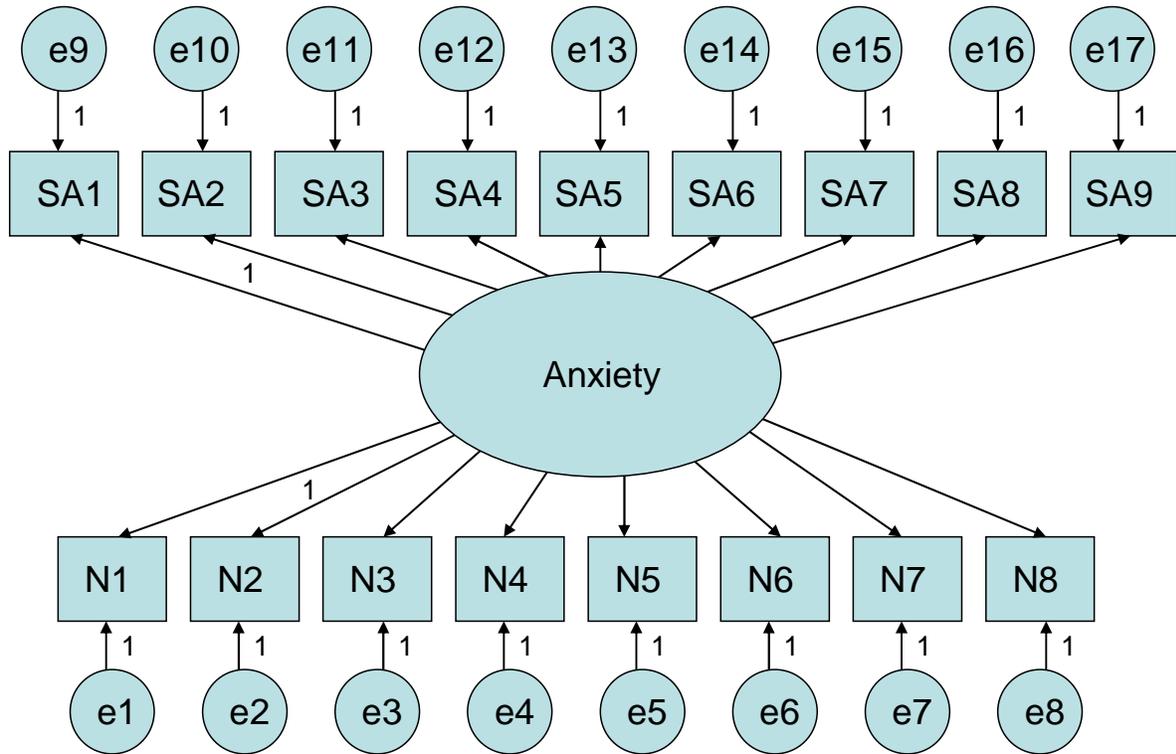
*Spatial Anxiety vs. Trait Anxiety: Factor Loading on Two Components*

	Component	
	1	2
Spatial Anxiety 1: Find way to appointment in unfamiliar city.	.299	.492
Spatial Anxiety 2: Find way out of unfamiliar, complex of offices	.161	.697
Spatial Anxiety 3: Find way in unfamiliar mall.	-.158	.683
Spatial Anxiety 4: Find way back after wrong turn while driving.	.187	.557
Spatial Anxiety 5: Point direction of outside destination while inside.	.129	.597
Spatial Anxiety 6: Locate car in large parking garage.	-.069	.660
Spatial Anxiety 7: Leave store for the first time and decide way to turn.	-.059	.770
Spatial Anxiety 8: Try new route, a shortcut without a map.	.187	.541
Spatial Anxiety 9: Use maps to find your way.	.067	.267
General Anxiety 1: You are depressed, blue.	.566	.197
General Anxiety 2: You are relaxed, and handle stress well.	.762	.015
General Anxiety 3: You can be tense.	.625	.235
General Anxiety 4: You worry a lot.	.713	.279
General Anxiety 5: You are emotionally stable, not easily upset.	.610	-.124
General Anxiety 6: You can be moody.	.581	.075
General Anxiety 7: You remain calm in tense situations.	.578	-.087
General Anxiety 8: You get nervous easily.	.678	.236

Confirmatory factor analyses were then conducted to test quantitatively whether anxiety was best represented as a single construct or as two separate constructs. The criterion adopted for these analyses was  $RMSEA < .10$ . The first model treated all items as representing a single construct: Anxiety (Figure 2). This model did not seem to fit the data well,  $\chi^2(1, 119) = 489.18$ ,  $RMSEA = .12$ ,  $CFI = .58$ . In the next model (Figure 3), spatial anxiety and general anxiety were independent constructs. This model fit the data better,  $\chi^2(1, 119) = 278.65$ ,  $RMSEA = .08$ ,  $CFI = .82$ . The final model tested spatial anxiety and general anxiety as two separate (though correlated) measures of a single construct, overall anxiety (Figure 4). This model fit the data well,  $\chi^2(1, 118) = 261.40$ ,  $RMSEA = .08$ ,  $CFI = .88$ . Of the uncorrelated and correlated models,

Figure 2

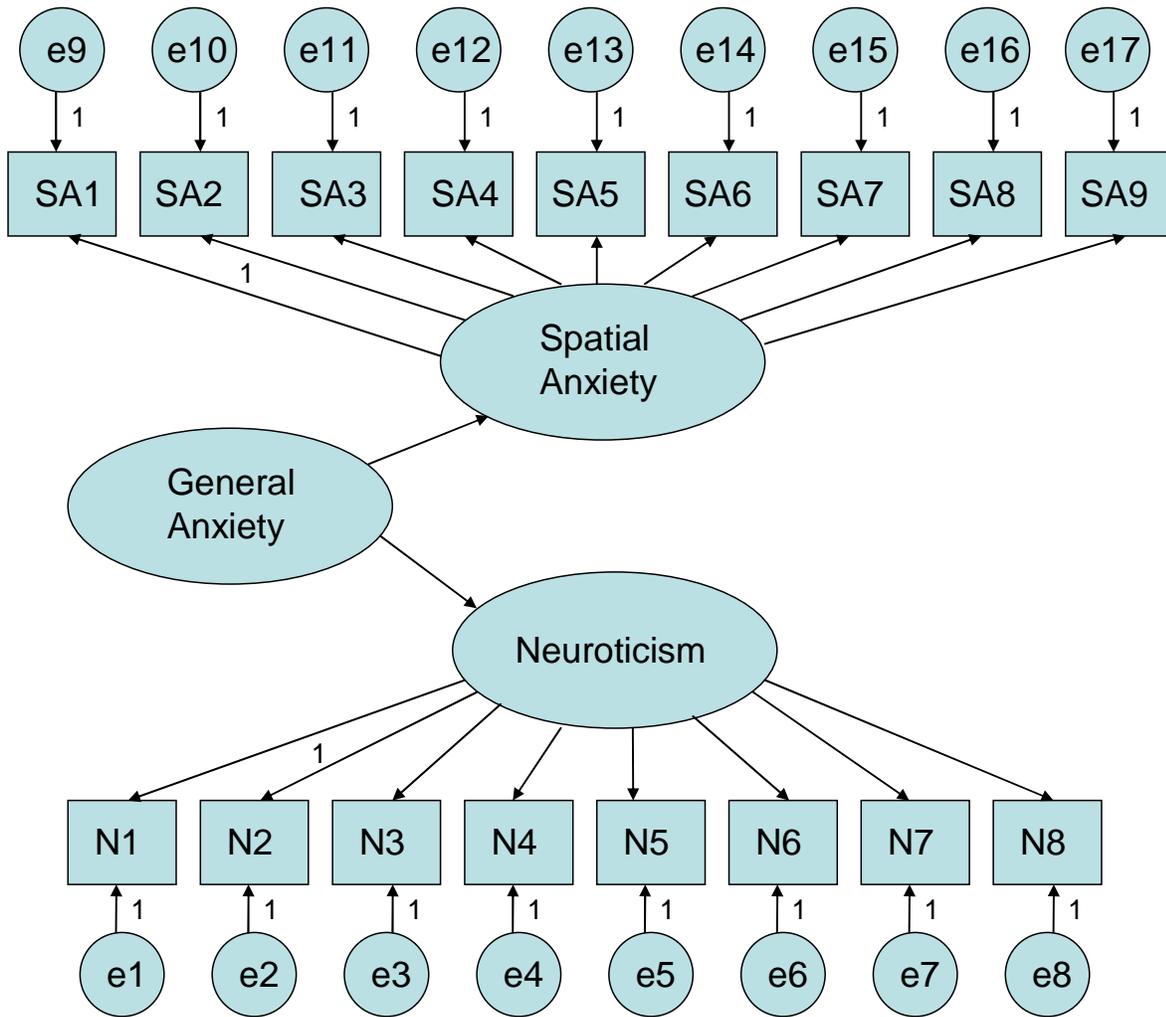
*Spatial Anxiety vs. Trait Anxiety: Model 1*



Complete Overlap

Figure 3

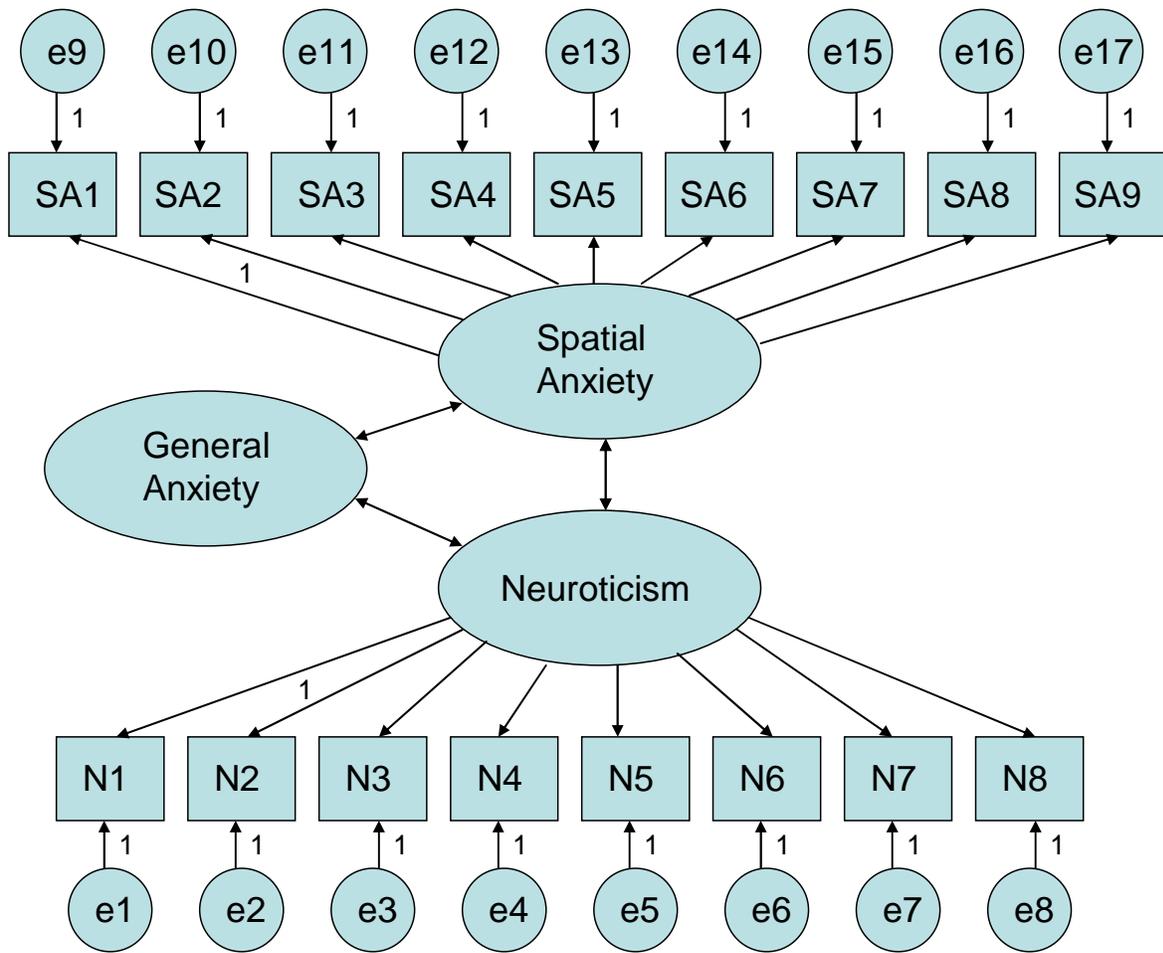
*Spatial Anxiety vs. Trait Anxiety: Model 2*



Independent Contribution: No Correlation

Figure 4

*Spatial Anxiety vs. Trait Anxiety: Model 3*



Partially Overlapping: Correlated

the correlated model provided the best fit,  $\chi^2(1) = 17.25, p < .001$ . No substantial increase in reliability resulted by the removal of any item in any of the models.

A further check on whether spatial anxiety is best considered as a more general anxiety construct was conducted by investigating its relation to other variables. On the spatial anxiety scale, the expected gender differences did not materialize (Table 7). Women did not report reliably higher levels of spatial anxiety ( $M = 3.78, SD = .98$ ) compared to men ( $M = 3.56, SD = 1.04$ ),  $t(100) = 1.01, p > .05$ , although the difference was in the predicted direction. However, the women did report higher levels of general anxiety ( $M = 3.83, SD = 1.03$ ) than men ( $M = 3.26, SD = .88$ ),  $t(100) = -2.83, p = .006$ . Another related variable is sense of direction. There is typically a gender difference, and there was in the current study, with men having a higher sense of direction ( $M = 4.61, SD = 1.01$ ) than women ( $M = 3.99, SD = 1.08$ ),  $t(100) = 2.76, p = .007$ . However, sense of direction was not related to spatial anxiety,  $r(101) = -.14, p = .078$ , and this was unexpected. Sense of direction was related to general anxiety,  $r(101) = -.39, p < .001$ .

Table 7

*Gender Differences of Experiment 1*

	Men		Women		t value	p value
	Mean	SD	Mean	SD		
Sense of Direction	4.61	1.10	3.99	1.08	2.76	0.007
Spatial Anxiety	3.56	1.04	3.78	0.98	-1.10	0.273
General Anxiety	3.26	0.88	3.83	1.03	-2.84	0.006
PT Walking	3.63	1.63	4.55	1.65	-2.72	0.008
PT Driving	3.55	1.46	4.13	1.46	-1.91	0.059

## 9. EXPERIMENT 1 DISCUSSION

For the driving situation, the only predictor of perceived threat was general anxiety; sense of direction, described environment, spatial anxiety, and gender did not predict perceived threat. It seems that an anxious person, regardless of the environment or sense of direction, perceives more threat than a less anxious person. Perhaps the increased availability of GPS systems in cars decreases the need for the participants to have a good sense of direction when in a driving environment. In other words, the car may insulate them from the wayfinding situation, and all they focus on is how anxious they are. Or, the general anxiety may stem singularly from the discomfort of being in an unfamiliar environment.

In a walking situation, however, gender, sense of direction and the description of the environment independently predicted perceived threat. Having a high sense of direction seems to ease the perception of threat. That is, the sense that one is capable of finding one's way corresponds with a lowered sense of vulnerability compared to those who sense that they may not be capable of finding their way. However, the described environment also impacted perceived threat. Regardless of one's sense of direction, environments that were described as more threatening resulted in higher perceived threat than environments that were described as benign. People who are confident that they can find their way nonetheless recognize that some environments have greater opportunities for bad outcomes than other environments, just as people with lower sense of direction recognize them. Also, women perceived greater amounts of threat from the walking environments than the men, which seems in line with the literature that

women report feeling more vulnerable while travelling through spaces compared to men (Pain, 1997). That neither spatial nor general anxiety correlated with perceived threat in a walking environment would suggest that sense of direction trumps anxiety. Perhaps sense of direction is more prominent in the participants' thoughts in a walking environment because they are preoccupied with attempting to find their way and not allowing themselves to monitor their anxious feelings.

The lack of relation between spatial anxiety and anything else is troubling. I expected to find a negative correlation between sense of direction and spatial anxiety (Lawton & Kallai, 2002; McKeen & Roskos-Ewoldsen, 2007). I found this relation between spatial anxiety and sense of direction using the Santa Barbara Sense of Direction Scale (a solid scale) in my previous research. However, Lawton had used a different sense of direction scale in her study. In addition, the participants in the Lawton and Kallai article included adults from two large cities, one in the United States and the other in Hungary. My participants, being young students in a college town, may not have the same sets of experiences, causing discrepancies in reported anxiety. Additionally, my study was conducted using online surveys whereas the Lawton and Kallai results were conducted with paper and pencil. Perhaps responding on hard copy makes for a more pensive response. As a final note, having found a relation between sense of direction and general anxiety, but not the expected relation between sense of direction and spatial anxiety, questions the relevance of spatial anxiety, and also suggests the importance of general anxiety in wayfinding tasks.

The other major focus of this study was on the nature of the relations between spatial and general anxiety. Frequently researchers think that definition alone separates two concepts from

each other, regardless of the measurement similarity. One could argue that researchers have been too comfortable assuming the nature of spatial anxiety, believing that it is rooted in unpleasant emotions specifically triggered by wayfinding or navigational activities. From an assessment or diagnostic perspective, one might validly question whether this wayfinding fear is better conceived as part of a larger, overarching personality trait. The results of the current factor analyses have empirically depicted a partial overlap between these two constructs, spatial anxiety and general anxiety. This should increase future researchers' caution in using spatial anxiety alone in their future projects. One must consider the possibility that general anxiety may be an important contributing factor to wayfinding.

The overall message coming away from the results of experiment 1 suggest: 1) that the variables that predict perceived threat in an environment differ depending on the mode of travel; 2) and that a model of spatial and general anxiety being correlated provides a better fit to the data compared to spatial and general anxiety being uncorrelated and to being completely overlapping. Unfortunately these results are tempered in their utility by the limitations of my experimental design. Spatial and general anxiety are trait characteristics, but my interests lay more towards state anxiety, and this project would undoubtedly have benefitted from dependent variables that were aimed more specifically towards the (temporary) effects of the manipulation, described environment (threatening vignette vs. non-threatening vignette). Not having used random assignment with the participants means that individual characteristics could be affecting the dependent variables in ways not controlled for. Additionally, the sample consisted of young students enrolled in psychology 101. Perhaps they have not the breadth of experiences for the

vignettes or wayfinding surveys to seem as meaningful as they might have been to the rest of the population.

The next question, addressed in experiment 2, is the extent to which spatial and general anxiety, described environments, gender, and perceived threat predict one's likelihood of asking a person for directions when lost.

## 10. EXPERIMENT 2 ASKING FOR DIRECTIONS

There is no published research addressing the variables that may play a role in the likelihood of asking for directions. However, in the unpublished thesis described earlier (McKeen & Roskos-Ewoldsen, 2007), participants completed a series of surveys including spatial anxiety and sense of direction measures. In addition, they completed a survey on the likelihood of asking a stranger for help when lost in an environment. I originally predicted that participants with more anxiety and less sense of direction would be more inclined to seek aid from someone else compared to those with less anxiety and higher sense of direction. This was not the case; sense of direction and spatial anxiety were predictors, yet in the opposite direction. It was found that willingness to ask for directions from a stranger positively correlated with sense of direction,  $r = .21, p < .001$ , and negatively with spatial anxiety,  $r = -.22, p < .001$ . Participants who were more willing to ask for directions had a higher sense of direction, but also lower spatial anxiety. Conversely, participants who were less willing to ask for directions indicated a lower sense of direction and also higher spatial anxiety. It appears that having higher anxiety trumps one's low sense of direction when deciding to ask a stranger for directions. After the fact, one can imagine that people who are anxious about finding their way in an environment may be hesitant to ask someone for directions compared to less spatially anxious participants, and perhaps also more anxious about being able to understand any instructions someone may give them.

In this second experiment, the central focus was on predicting the likelihood of asking for directions from another person. This question was approached from two perspectives. One was to carry over the variables from experiment 1 (spatial anxiety, general anxiety, described environmental threat, perceived environmental threat, and gender) to investigate whether, and to what extent, they were related to likelihood of asking for directions. It is likely that general anxiety will predict asking, but it is unclear whether spatial anxiety or environmental threat will predict asking, given the results of experiment 1.

A second focus was to investigate the determinants of the likelihood of asking for and giving directions. Two variables that are likely to be involved are the familiarity of the person being interacted with (stranger vs. acquaintance) and the gender of the participant. Here it is likely that there will be an interaction between gender and familiarity, at least for asking. Based on the social literature, men are expected to be more willing to ask for directions from a stranger than an acquaintance, to protect their self esteem. In contrast, women are expected to be more likely to ask for directions from an acquaintance than a stranger. Further, if the results from the McKeen and Roskos-Ewoldsen (2007) study are replicated, then men will be more willing to ask for directions, at least from strangers, than women. In terms of giving directions, it is expected that men will be more likely to give directions, at least to strangers, than women, based on the results from McKeen and Roskos-Ewoldsen (2007).

## 11. EXPERIMENT 2 METHODS

*Design.* The design was mixed, with spatial anxiety, general anxiety, perceived threat in a walking scenario, and perceived threat in a driving scenario serving as continuous, within-subjects independent variables, and described environment (threatening, non-threatening) and gender of the participant as dichotomous, between-subjects independent variables. Familiarity of the person with whom the participant hypothetically interacted with (stranger, acquaintance) was used as a dependent variable in some analyses and as a dichotomous, within-subjects independent variable in others. Otherwise, there were two main dependent variables: likelihood of asking for directions and likelihood of giving directions.

*Participants.* To determine the number of participants to be recruited, a power analysis was conducted. Although there is no extant literature on the role of anxiety and threat on likelihood of asking for directions, the relation between spatial anxiety and likelihood of asking for directions tends to be moderate in size,  $r = -.22$  (McKeen & Roskos-Ewoldsen, 2007). A priori power analyses indicated that using around 103 participants was a large enough sample to detect a moderate effect in a regression analysis,  $f^2 = .11$ , power = .80 and alpha = .05 (Faul, & Erdfelder, 1992). In this experiment there were 102 participants (29 male, 73 female). The participants were recruited from the research participant pool in the Psychology Department at The University of Alabama, representing students enrolled in Psychology 101, and had not participated in experiment 1. They were given credit towards fulfilling a course requirement.

*Measures.* This study used the same demographics form used in the previous experiment (gender, age, ethnicity/race) along with the Spatial Anxiety Scale, which included the imbedded general anxiety questions. In addition, the same vignettes (threatening and non-threatening) and the measure of perceived threat were used to detect the extent of one's perceived threat in an environment.

The one new measure used in experiment 2 was the Likelihood of Engaging in Social Wayfinding scale. The Likelihood of Engaging in Social Wayfinding scale is an eighteen-item instrument developed specifically to measure a respondent's willingness to ask for and give directions in a wayfinding situation (McKeen & Roskos-Ewoldsen, 2007). The scale includes statements such as "I am comfortable giving directions to others" or "I am comfortable going alone when I am going somewhere new" (Appendix F). For each statement the participants, using a likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), indicated the extent to which they agreed that these statements applied to themselves. Reliability data from the McKeen and Roskos-Ewoldsen (2007) study indicates that the scale is moderately stable (Cronbach alpha = .60). The acquaintance scores came from questions 1, 3, 7, 9, 11, and 13. The stranger scores were derived from questions 2, 4, 8, 10, 12, and 14. The questions on giving directions were 1, 2, 7, 8, 9, and 10. The questions on asking for directions were 3, 4, 11, 12, 13, and 14.

*Procedures.* As in experiment 1, this study was designed so that all of the data collection was done online through the University of Alabama's subject pool website, which contains its own questionnaire builder. The two vignette conditions were presented on the subject pool website as two different studies. Further, having participated in one of the conditions caused one

to become ineligible to participate in the other, as this project was a between subjects experimental design.

As participants signed up for the online survey research, they were first asked to read over their rights as a participant. Completion of the surveys was regarded as giving consent. After that, every participant was asked to complete the demographics questionnaire and then the questionnaire about their spatial anxiety. Afterwards the participants read two vignettes, both using a threatening environment or both using a non-threatening environment, depending on the condition. Within each pair, one vignette described an environment through which the participant was driving and the other through which the participant was walking. After reading the vignettes they completed the Likelihood of Engaging in Social Wayfinding scale, followed by the perceived threat measure. Then each participant was presented with a message thanking them for their participation and giving them a short debriefing as to the purposes of the study. Data collection took no more than a half hour.

## 12. EXPERIMENT 2 RESULTS

The variables were checked for normalcy and reliability. Normalcy was checked by looking at the variables plotted as histograms and reporting the skewness and kurtosis (Table 1). All variables had acceptable levels of skewness ( $< 1$ ) and all but two had traditionally acceptable levels of kurtosis ( $< 2$ ). Willingness to ask for and give directions with familiar persons demonstrated mildly leptokurtic distributions. Because the value was less than 3.00, it was not considered severe enough for special attention in further data analyses. In addition to normalcy and reliability, the scales had acceptable internal reliability. The Cronbach alpha for the spatial anxiety questions was .78. The questions on general anxiety showed a Cronbach alpha of .82. The Likelihood of Engaging in Social Wayfinding scale showed a Cronbach alpha of .86. These statistics provide enough evidence that further analyses may proceed.

The first question addressed in experiment 2 was whether and to what extent general anxiety, spatial anxiety, described environment, perceived threat, and gender predict the likelihood of asking for directions. To begin, two analyses were conducted; one for asking strangers and one for asking acquaintances. For each analysis a regression analysis was conducted with spatial anxiety, general anxiety, described environment (threatening, non-threatening), perceived threat (walking and driving), and gender as independent variables. Additionally the interactions of gender and all the other variables were included in a hierarchical linear regression. In terms of asking for directions from strangers, the results showed that the overall model was significant,  $F(6, 95) = 3.51, p < .01, \text{adj. } R^2 = .13$  (Table 8). This result was

Table 8

*Regression Analysis of Spatial and General Anxiety, Described Environment, Perceived Threat (Walking and Driving), and Gender Predicting Likelihood of Asking a Stranger for Directions*

Model	R <sup>2</sup>	Adj. R <sup>2</sup>	Std. Error	$\Delta R^2$	$\Delta F$
1	.18	.13	1.20	.18	3.51*
2	.20	.10	1.21	.02	.45

	Unstandardized Coefficients		Standardized Coefficients	t value	Correlations	
	B	Std. Error	Beta		Partial	Part
Model 1						
Constant	4.85	.50				
Spatial Anxiety	-.11	.13	-.09	-.85	-.09	-.08
General Anxiety	-.41	.13	-.33	-3.18*	-.31	-.30
Described Env.	-.12	.14	-.09	-.83	-.09	-.08
Perc. Threat Walk	-.02	.09	-.03	-.24	-.03	-.02
Perc. Threat Drive	.05	.09	.06	.52	.05	.05
Gender	-.50	.28	-.18	-1.79	-.18	-.17
Model 2						
Constant	4.61	.55				
Spatial Anxiety	-.01	.65	-.01	-.02	-.002	-.002
General Anxiety	-.13	.59	-.10	-.22	-.02	-.02
Described Env.	.21	.53	.16	.39	.04	.04
Perc. Threat Walk	-.47	.39	-.62	-1.19	-.13	-.11
Perc. Threat Drive	.02	.34	.02	.05	.01	.01
Gender	-.39	.30	-.14	-1.31	-.14	-.12
Gender X SA	-.06	.35	-.09	-.17	-.02	-.02
Gender X GA	-.18	.32	-.25	-.55	-.06	-.05
Gender X Des. Env.	-.21	.31	-.29	-.68	-.07	-.06
Gender X PTW	.27	.22	-.62	1.21	.13	.11
Gender X PTD	.02	.19	.03	.08	.01	.01

Dependent Variable: Likelihood of Asking a Stranger for Directions

\*p < .05, \*\*p < .001

driven primarily by general anxiety,  $t(101) = -3.18, p = .002$ . The higher one's general anxiety was, the less likely they were to ask for directions. Spatial anxiety, described environment, perceived threat (walking and driving), and gender were not related to asking for directions from a stranger. None of the interactions added significantly to the model,  $\Delta F(5, 90) = .45, p > .05$ ,  $\text{adj. } \Delta R^2 = .02$ . In terms of asking for directions from people they knew, the results showed that none of the variables were predictive,  $F(6, 95) = 2.15, p > .05$ ,  $\text{adj. } R^2 = .06$ .

A similar pattern of results occurred in terms of the likelihood of giving directions. In terms of giving strangers directions, the results showed that the overall model was significant,  $F(6, 95) = 2.45, p = .03$ ,  $\text{adj. } R^2 = .08$  (Table 9). This result was driven primarily by general anxiety,  $t(101) = -2.51, p = .01$ . The higher one's general anxiety was, the less likely one was to give directions to strangers. Spatial anxiety, perceived threat in the driving and walking environments, described environmental threat, and gender were not related to giving directions to strangers. None of the interactions added significantly to the model,  $\Delta F(5, 90) = .41, p > .05$ ,  $\text{adj. } \Delta R^2 = .02$ . In terms of giving directions to people they knew, the results showed that none of the variables were predictive,  $F(6, 95) = 1.77, p = .11$ ,  $\text{adj. } R^2 = .04$ .

Next, likelihood of asking for and giving directions by gender of the participant and the familiarity of the person being interacted with (stranger, acquaintance) was investigated. Two separate analyses were conducted, one for the likelihood of asking for directions and the other for the likelihood of giving directions. First, in terms of likelihood of asking for directions, all participants were more likely to ask for directions from someone they knew compared to a stranger (stranger:  $M = 3.99, SD = 1.28$ ; acquaintance:  $M = 6.51, SD = .83$ ),  $F(1,100) = 271.53, p < .001$ . Second, there was not a difference between men and women (women:  $M = 5.28, SD =$

Table 9

*Regression Analysis of Spatial and General Anxiety, Described Environment, Perceived Threat (Walking and Driving), and Gender Predicting Likelihood of Giving a Stranger Directions*

Model	R <sup>2</sup>	Adj. R <sup>2</sup>	Std. Error	$\Delta R^2$	$\Delta F$
1	.13	.08	1.22	.13	2.45*
2	.15	.05	1.24	.02	.41

	Unstandardized Coefficients		Standardized Coefficients	t value	Correlations	
	B	Std. Error	Beta		Partial	Part
Model 1						
Constant	4.61	.51				
Spatial Anxiety	-.004	.13	-.003	-.03	-.003	-.003
General Anxiety	-.33	.13	-.27	-2.51*	-.25	-.24
Described Env.	.24	.15	.19	1.63	.17	.16
Perc. Threat Walk	-.17	.10	-.22	-1.75	-.18	-.17
Perc. Threat Drive	-.01	.09	-.01	-.07	-.01	-.01
Gender	-.18	.29	-.06	-.62	-.06	-.06
Model 2						
Constant	4.64	.56				
Spatial Anxiety	-.62	.66	-.50	-.93	-.10	-.09
General Anxiety	.49	.60	.39	.81	.09	.08
Described Env.	.10	.54	.08	.18	.02	.02
Perc. Threat Walk	.04	.40	.05	.09	.01	.01
Perc. Threat Drive	-.15	.35	-.19	-.44	-.05	-.04
Gender	-.19	.31	-.07	-.63	-.07	-.06
Gender X SA	.33	.36	.48	.92	.10	.09
Gender X GA	-.45	.33	-.64	-1.39	-.15	-.13
Gender X Des. Env.	.07	.31	.10	.23	.03	.02
Gender X PTW	-.10	.22	-.25	-.47	-.05	-.05
Gender X PTD	.08	.20	.18	.43	.05	.04

Dependent Variable: Likelihood of Giving a Stranger Directions

\* $p \leq .05$ , \*\* $p < .001$

.84; men:  $M = 5.28$ ,  $SD = 1.03$ ),  $F(1,100) = .004$ ,  $p > .05$ . However, familiarity and participant gender interacted to predict the likelihood of asking for directions (Figure 5),  $F(1,100) = 15.43$ ,  $p < .001$ . In particular, while both men and women prefer to ask known individuals for directions, the disparity between willingness to approach strangers vs. a known person is more extreme for women than it is for men. The men were significantly more likely to ask strangers for directions and significantly less likely to approach someone they knew compared to the women (Table 10.1). Conversely, the women were significantly less likely to ask strangers for directions and significantly more likely to approach someone they know compared to the men (Table 11).

Table 10.1

*Means (Standard Deviations) of Likelihood of Asking for Directions by Status of the Person Asked (Stranger vs. Acquaintance) and Gender of the Asker*

The Person Asked	Gender of Asker	
	Male	Female
Stranger	4.39 (1.29)	3.84 (1.25)
Acquaintance	6.13 (1.08)	6.65 (.66)

Regarding giving directions, first, all participants were more likely to give directions to someone they knew compared to a stranger (stranger:  $M = 4.31$ ,  $SD = 1.27$ ; acquaintance:  $M = 6.14$ ,  $SD = 1.17$ ),  $F(1,100) = 156.91$ ,  $p < .001$ . Second, there was not a difference between men and women in terms of their likelihood of giving directions (women:  $M = 5.28$ ,  $SD = 1.05$ ; men:  $M = 5.29$ ,  $SD = 1.06$ ),  $F(1,100) = .10$ ,  $p > .05$ . However, familiarity and participant gender interacted to predict the likelihood of giving directions (Figure 6),  $F(1,100) = 4.90$ ,  $p < .05$ .

Table 11

*Gender Differences in Experiment 2*

	Men		Women		t value	p value
	Mean	SD	Mean	SD		
Spatial Anxiety	3.28	0.96	3.52	1.07	-1.04	0.303
General Anxiety	3.64	1.05	3.70	1.02	-0.25	0.803
PT Walking	4.00	1.46	5.12	1.70	-3.13	0.002
PT Driving	4.00	1.67	4.59	1.53	-1.71	0.090
Give Strangers	4.57	1.22	4.20	1.29	1.34	0.183
Ask Strangers	4.39	1.29	3.84	1.25	2.00	0.048
Give Acquaintances	5.98	1.06	6.21	1.22	-0.89	0.378
Ask Acquaintances	6.13	1.08	6.66	0.66	-3.03	0.003

Figure 5

*Likelihood of Asking for Directions by Status of the Person Being Asked (Stranger, Acquaintance) and gender of Participant (Female, Male)*

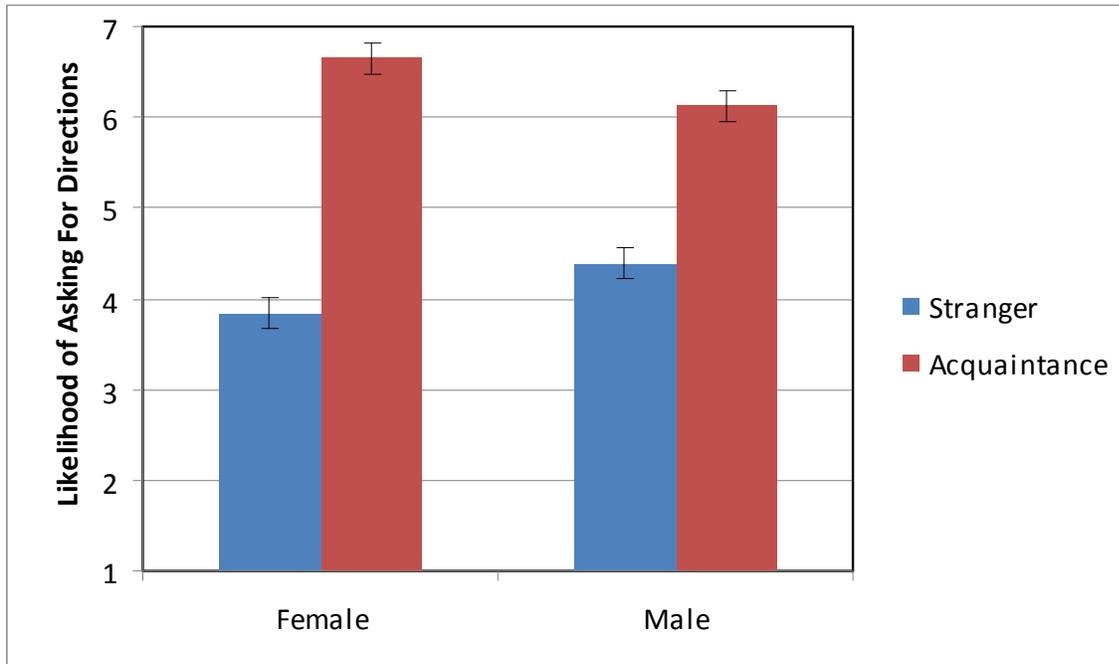
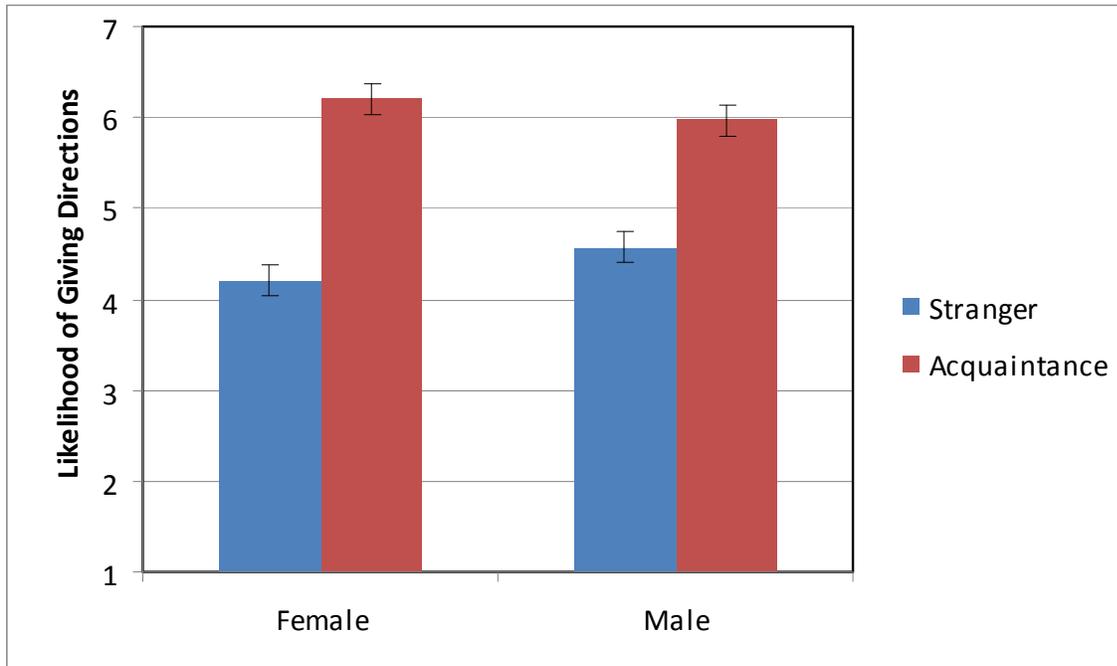


Figure 6

*Likelihood of Giving Directions by Status of the Person Asking (Stranger, Acquaintance) and gender of Participant (Female, Male)*



In particular, while both men and women prefer to give directions to known individuals, the disparity between willingness to give directions to strangers vs. a known person is more extreme for women than it is for men. The men tended to be less likely to give strangers directions yet more likely to give someone they knew directions compared to women (Table 10.2). The women tended to be more likely to give acquaintances directions yet less likely to give strangers directions compared to the men.

Table 10.2

*Means (Standard Deviations) of Likelihood of Giving Directions by Status of the Person Asked (Stranger vs. Acquaintance) and Gender of the Giver*

The Person Given	Gender of Giver	
	Male	Female
Stranger	4.57 (1.22)	4.20 (1.29)
Acquaintance	5.98 (1.06)	6.21 (1.22)

### 13. EXPERIMENT 2 DISCUSSION

There was a relation between general anxiety and likelihood of asking for directions from strangers: participants with lower general anxiety were more likely to ask for directions than those with higher general anxiety. It seems reasonable that people experiencing a significant amount of anxiety should feel more hesitant about approaching someone they don't know. That would explain why the anxious participants were also more hesitant about giving directions to strangers. But, anxiety had no predictive ability when it came to willingness to ask directions from a known individual. One could argue that seeking aid from a familiar person would seem as desirable to an anxious person as it would to a non-anxious individual, because, for those high in anxiety, it could help alleviate some of that anxiety felt towards the navigational task. These results clarify one question that arose from an earlier study (McKeen & Roskos-Ewoldsen, 2007). In that study, I predicted that high spatial anxiety participants would be more likely to ask for directions from strangers; the reasoning was that their increased discomfort with a wayfinding situation would motivate them to seek help. Yet what I found was that low spatial anxiety participants were more willing to ask for directions than high anxiety participants. Having refined the Likelihood to Engage in Social Wayfinding measure in the current study, I was able to differentiate between willingness to approach strangers vs. acquaintances. The earlier study had only willingness to approach strangers. In the current experiment, high amounts of general anxiety predicted lower likelihood of approaching a stranger for directions, yet general anxiety was not a predictor for asking directions from acquaintances. Highly anxious

participants and non-anxious participants were equally likely to want to approach an acquaintance for directions. It is likely that the earlier study captured general anxiety to some extent; if this is the case, it makes sense that generally anxious people would not want to approach a stranger for help. The word “stranger” has an arguably negative connotation to it. Known individuals are people one can understand as being, at one level or another, similar to us, a concept that is frequently brought up in helping behavior research emphasizing the importance of group membership (Sturmer, Snyder, Kropp, & Siem, 2006).

Spatial anxiety was not a predictor for being likely to ask for directions from strangers or acquaintances, though the non-significant results were in the expected direction; higher amounts of spatial anxiety corresponded with a lower likelihood to ask for directions from strangers. This once again points towards general anxiety being an important component of the individual characteristics which influence wayfinding behavior. Though the questions on the spatial anxiety scale are worded specifically on navigational issues, it does not seem to be capturing the variability explained by an individual’s anxiousness.

It seems reasonable that the idea of approaching a stranger causes participants to behave more hesitantly. But why aren’t they significantly affected by perceived threat from the environment? Experiment 1 demonstrated that perceived threat is related to general anxiety. If being more generally anxious predicts perceiving greater amounts of threat, and higher levels of general anxiety predict the likelihood of approaching strangers for directions, why does perceived threat not predict this likelihood as well? It could be that the manipulation of environmental threat, though statistically sound, was not strong enough on the 1-7 scale used to measure threat. The threatening vignettes were rated at slightly above the middle of the scale of

perceived threat, whereas the non-threatening vignettes were slightly below. It also could be that I over-estimated the importance of environmental cues of danger or safety in a wayfinding situation. Are people even really paying attention to these aspects of a situation in real navigational tasks? I will have to turn to the results of the third experiment, a qualitative analysis of retrospective reports on wayfinding experiences, to help answer this question.

It seems reasonable that general anxiety would be related to likelihood of giving directions to a stranger. The more anxious one is in general, arguably the more likely they are to hesitate in interacting with someone who they do not know. It is easy to picture an anxious individual being nonplussed at the idea of being approached by a stranger. General anxiety was negatively correlated with sense of direction in experiment 1, perhaps anxious people are already too intimidated at the thought of a navigational task to be approached by a stranger. This idea could have been explored had I included sense of direction in experiment 2's measurements.

It was not surprising to find that women reported being less willing to ask for directions from strangers than men, since that was in line with the findings in the earlier study (McKeen & Roskos-Ewoldsen, 2007). The fact that they were less likely to talk to strangers, but more inclined to ask for help from acquaintances than men, falls in line with the social affiliation literature. Women look for aid in ways that alleviate anxiety by introducing comfort and companionship into the situation. Men typically seek aid directed towards goal accomplishment (Taylor et al., 2000; Taylor et al., 2002; Doss & Christensen, 2006).

It had been predicted that the male participants would report being less interested in asking for directions from acquaintances compared to women. One's desire to be helped by a fellow group member can be mediated by how central a task is to one's self image. As

mentioned in the introduction, Nadler (1987) had participants measured on their self esteem and on how central the ability to complete a task was to their self image. Participants with high self esteem who also saw the task as being central to their self image refused help from fellow group members. Non-group members were presumably less intimidating, as they would be less likely to judge one for being ineffective at a task they were less likely to care about. The male participants in this experiment were less willing to ask for directions from known individuals compared to the women. This could be indicating their desire to avoid seeming navigationally incompetent in front of someone they know. Sense of direction and wayfinding ability are talents stereotypically associated with the male gender, making them arguably more central to the male self image. These stereotypes could contribute to the male participant's desire to hide any wayfinding inadequacies from anyone of potential importance in their lives, in other words, people they know. This could also help explain the perplexing results that men tended to be less likely to give directions to someone they know while being more likely to give directions to a stranger, compared to women. Perhaps the risk associated with potentially giving poor directions is capping the willingness men show towards known persons, who could shame the direction giver with a poor assessment of their wayfinding abilities.

The primary conclusions of experiment 2 are : 1) general anxiety predicts the likelihood of interacting with a stranger, whether giving or asking for directions; 2) general and spatial anxiety, described environmental threat, perceived threat, and gender do not predict the likelihood of interacting with an acquaintance; and 3) congruent with the affiliation and help-seeking literature, gender interacts with familiarity of the interactant in terms of asking for and giving directions. Unfortunately the utility of these results are once again limited, as this

experiment, like the first, is hampered with issues of non-random assignment, the utilization of trait measurements not specific to the manipulation of the described environment independent variable, and all of the measurements were made with a young and inexperienced sample. Truly the largest error was running the first and second experiments at the same time. Had the first one been run on its own, analyzed and pondered over, perhaps most of these issues would have been corrected for the second experiment.

I answered some questions about willingness to ask for or give directions, but the results from the experiment also raised more questions. What are the circumstances under which we get lost in an environment? What strategies do we use to eventually find our way in real world wayfinding tasks? These questions are addressed in Study 3.

#### 14. STUDY 3 WAYFINDING BEHAVIOR

As mentioned earlier, the third study is a retrospective look at individuals' descriptions of the last time that they remembered having been lost by themselves. While the second study investigated the likelihood of asking for and giving directions, it did not provide any information about the actual circumstances that people find themselves in when they get lost. Research on people's experiences when they become lost or disoriented is particularly sparse. This study fills that gap. It is intended to answer questions including: what were people thinking and feeling? What behaviors did they exhibit when trying to find their way? From whom did they ask directions when they needed assistance? In this qualitative study, participants described in an essay a situation in which they were lost or disoriented. Responses were coded in terms of the physical characteristics of the situation, whether participants mentioned thoughts about themselves (e.g. being anxious and/or unsure of their wayfinding ability), thoughts about their environment (e.g. perceived threat/safety concerns), strategies they used to find their way, including whether they asked for help, and, if so, why they approached that person. These results are necessarily descriptive.

When using retrospective analysis it is important to acknowledge the limitations which come with this methodology. Relying on participants' memories has problems like faulty memory, social desirability bias, dishonesty, demand characteristics, and experimenter bias. Memory has shown to be frequently unreliable; recollections come from the amalgamations of separate cognitive processes (Gardner, 2001, Snelgrove & Havitz, 2010). Error can be

introduced as one encodes the information during an experience and then error can be introduced again when retrieving the information for the purposes of reconstructing the memory of the experience later on (Lloyd, 2007). Participants are also likely to report recollections which paint them in the most positive light possible. It is quite possible that many of the essays under-report thoughts and feelings which would be considered socially undesirable, such as feeling fear or admitting one is less than capable (Guadagno, Muscanell, Okdie, Burk, & Ward, 2011; Weinstein & Roediger, 2010). Participants may feel pressured to make-up something or lie when responding to the essay or the essay's follow up questions in an effort to provide information that they perceive the researchers want (Damaser, Whitehouse, Orne, Orne, & Dinges, 2010). Unfortunately this study includes no controls built in to verify the truthfulness of these responses. Experimenter bias can be introduced through coders consciously or subconsciously interpreting the data in ways that will support the hypothesis (Guadagno, et al., 2011). Attempts were made to limit the effects of experimenter bias by not allowing the author to act as a coder and training coders who were not knowledgeable as to the purposes of the study. The decision to proceed with this design despite its weakness came from the potential hope to bridge the quantitative cognitive studies on wayfinding to the qualitative studies from the geographical literatures.

## 15. STUDY 3 METHODS

*Participants.* There is no prior research on this to use as a guide for a power analysis. Instead, I decided to focus on finding moderate or large effects. A priori power analyses suggested 50 participants, expecting a moderate to large effect size,  $w = .40$ , power = .80, and alpha = .05 (Faul, & Erdfelder, 1992). There were 55 participants in this third study, 3 whose data were removed because they did not follow instructions, leaving 19 males and 33 females. The participants were recruited from the research participant pool in the Psychology Department at The University of Alabama, representing students enrolled in Psychology 101. They were given credit towards fulfilling a course requirement.

*Measures and procedures.* The data was collected in person. As participants arrived, they were first assigned a participant identification number, which was also listed on the questionnaires they were to complete. They were asked to read over their rights as a participant. Completion of the surveys was regarded as giving consent. Every participant was asked to fill out the same demographics sheet used in the previous experiments (Appendix A). The participant's gender was collected on this form along with their age and race/ethnicity.

Afterwards, they were given a survey about the last time that they were lost or disoriented by themselves, called the Wayfinding Experience Essay (Appendix G). For this essay they were asked to imagine the last time that they were by themselves and lost or disoriented while finding their way in an environment. They indicated their level of disorientation in that situation on a 1 (*very slightly disoriented*) to 7 (*completely lost*) scale. Next they described in a paragraph the

situation in which they were lost or disoriented. As a follow up, they answered questions that were directly relevant to the hypotheses of interest. The supplementary questions were: How were you travelling? (for example, walking, driving, etc.); How did you get lost?; What kind of place was it?; What time of day was it?; How long were you lost or disoriented?; What were you feeling?; What were your thoughts?; What did you do to make yourself no longer lost?; Did you look for someone to give you directions?; How many people did you see that you could have asked for directions?; If you approached someone for directions, describe that person: their age, appearance, gender, ethnicity, whatever you remembered about them; and, Why do you think you chose to approach that person for directions, as opposed to another individual? Upon completion of the Wayfinding Experience Essay the participants were thanked, debriefed, and dismissed. Participation took no longer than a half hour.

Information on the situational aspects of the wayfinding experience and on the participants' thoughts and behaviors were extracted from the essays. The additional questions were used only to clarify points of confusion. The Retrospective Study Participant Response Coding Sheets were developed (Appendix H) for the purpose of coding the essays. The essays were coded for situational information along four dimensions: a) type of environment (urban, rural, or suburban/campus environment); b) mode of travel (walking, driving, other); c) time spent lost (less than thirty minutes, more than thirty minutes); d) time of day [day (7:00am to 7:00pm) or night (7:00pm to 7:00am)]. Regarding the thoughts of the participants, the essays were coded along two dimensions: a) whether there were statements questioning their sense of direction (e.g., frustrated with their own choices, questioning their own ability, describing the environment as too confusing for them); and b) whether they made statements about feeling

anxious (e.g., feeling afraid, contemplating personal safety, contemplating the safety of the environment). Regarding the behaviors of the participants, the essays were coded for: a) the type of behavior taken to find their way (e.g., working it out on their own, contacting a known person for help, approaching a stranger for directions); b) whether they attempted to seek a potential direction giver in the environment; and c) how populated the area was (i.e., couple = 2, few = 3, large crowds or just “lots of people” = 99). If they did approach a stranger for directions, their responses were coded for: what they remembered about that person (gender, age, ethnicity), and the reasons they reported for wanting to approach this specific person (e.g., competent appearance, safe appearance, other).

There were two independent coders, one undergraduate student and one graduate student, neither of whom knew about the purposes of the study. They were trained by the author. Their coding was identical 91% of the time (1,026 out of 1,125);  $r = .81$ ,  $p < .001$ . A third coder, not associated with the study, settled disagreements.

## 16. STUDY 3 RESULTS

The average degree of disorientation on the 1 (*very slightly disoriented*) to 7 (*completely lost*) scale was  $M = 4.33$  ( $SD = 1.54$ ). Men and women participants did not differ significantly on these ratings (men:  $M = 3.89$ ,  $SD = 1.45$ ; women:  $M = 4.58$ ,  $SD = 1.56$ ),  $t(50) = 1.55$ ,  $p > .05$ .

The situational data collected from the Wayfinding Experience Essays are presented as percentages in Table 12.1. The majority of participants wrote essays about experiences that took place in a suburban environment or on campus (56%). There was a fairly even split between driving (52%) and walking (46%) situations. The majority of the experiences lasted for longer than thirty minutes (62%), and the majority of the experiences took place during the day (71%).

In terms of their thoughts, there were frequent statements made of an emotional quality: remembering “I was afraid”, I felt “scared and frightened”, or being “nervous about the situation.” Participants frequently made statements regarding concern directed towards their own safety like “I was worried about getting back safely”, “I hope I don’t get carjacked”, or noted having felt “discomfort since I was by myself.” Oftentimes participants reported attending to unpleasant aspects of the surrounding environment: “The road was sketchy”, “it was dark”, “the area looked bad”, and “only creepsters come out that late.” Statements connected to anxious feelings were made by more than a third of the participants, while statements connected to sense of direction were made by at least half. Sixteen of the 33 female participants made anxious statements, as did eight of the 19 male participants. Participants reported feeling “angry with myself for getting lost”, or “embarrassed about being lost”, and “worried about being late.”

Table 12.1

*Situational Aspects of the Participant’s Wayfinding Experiences*

Environment Type (n = 52)			Mode of Travel (n = 52)			Time Spent Lost (n = 52)	
Urban	Rural	Suburban/ Campus	Walk	Drive	Other	< 30	> 30
28.85 %	15.38%	55.77%	46.15%	51.92%	1.92%	38.50%	61.50%
Time of Day (n = 52)							
Day		Night					
71.20%		28.80%					

Table 12.2

*Percentage of Participants Reporting Perceived Threat/Safety Concerns and Skill Issues*

Feelings and Observations RE: Safety/Anxiety (n = 52)			Feelings and Observations RE: Skill Issues (n = 52)		
feeling afraid	thinking about safety	environmental characteristics re: safety	frustrated with obstacles/ choices	questioning ability	confusion re: environmental characteristics
42.31%	32.69%	28.85%	75.00%	53.85%	63.46%

Note: Percentages do not add up to 100%: Non-mutually exclusive categories.

Table 12.3

*Percentage of Participants Who Reported Actions Taken to No Longer Be Lost, Reported Attempts to Look for Help from Unknown Persons, and Information Regarding Why They Approached Unknown Persons*

Behavior: how they were no longer lost (n = 52)				Approaching Unknown Person (n = 14)	
working it out alone	contacting known person (calling)	contacting unknown person	looking for helpful opportunities	competent appearance	safe appearance
40.38%	32.69%	26.92%	44.23%	42.86%	21.43%

Note: Percentages do not add up to 100%: Non-mutually exclusive categories.

Questions about one's own ability are apparent in statements like "my sense of directions was messed up", and "feeling helpless". Thirty-one of the 33 female participants made statements related to worrying about their own sense of direction, as did all 19 of the male participants. Common complaints among participants were things like "the area looked confusing", "all the big buildings were intimidating", and "the street signs were not helpful."

The percentages of participants who made statements about different thoughts are presented in Table 12.2. The majority of students did not make anxious statements. When they did, they were most likely to say that they were afraid (42%). Less than a third of the participants mentioned personal safety issues or concerns about features of the environment that made it unsafe. In contrast, the majority of students made statements regarding their wayfinding abilities: 75% reported being frustrated with the wayfinding choices they had made, 54% reported questioning their own sense of direction, and 63% commented on how features of the environment were confusing or made it too difficult for them to find their way.

Regarding the participants' behaviors when finding their way out, there was no single behavior endorsed by the majority of the students (Table 12.3): 40% reported working out the problem on their own; 33% relied on contacting someone who they knew for directions, typically by cell phone; only 27% reported asking someone who they did not know for directions. More people may have engaged in asking a stranger for directions had they been able to locate someone they felt was approachable; 44% reported looking for someone from whom they might feel comfortable asking for directions.

As seen in experiment 2, the participants were more likely to interact with someone they knew, compared to a stranger, when needing to ask someone for directions. Of the small number

of participants who had asked a stranger for directions: 43% reported wanting to approach the person for their competent appearance while 21% reported approaching them for their safe appearance (Table 12.3). It would seem that the features of the stranger that were under consideration compensated for the participants' feelings of anxiety (the stranger's safe appearance) and/or poor sense of direction (the stranger's competent appearance).

One question that arose was whether situations, thoughts, and behaviors differed depending on the extent to which the participants were disoriented. To investigate this possibility, the participants were divided into two groups depending on their response to the question about the extent of their disorientation. The scale ranged from 1 (*very slightly disoriented*) to 7 (*completely lost*). Participants who rated themselves as not very disoriented (1, 2, or 3) were placed in the non-disoriented group (n = 14), and participants who rated themselves as disoriented or lost (5, 6, or 7) were placed in the disoriented group (n = 23). Participants who rated themselves a 4 (n = 15) were not included in these analyses. The aforementioned percentages were recalculated for each of these groups.

Percentages for non-disoriented participants are presented in Tables 13.1, 13.2, and 13.3, and the percentages for disoriented participants are in Tables 14.1, 14.2, and 14.3. There were a few striking differences between the two groups. In terms of the situation, the non-disoriented participants were far more likely to find themselves disoriented in a suburban/campus environment (71%) compared with urban and rural environments. The disoriented participants were more evenly spread across the three types of environments. For both groups, the situations were 50% walking and 50% driving. Not surprisingly, those who were non-disoriented found their way within 30 minutes (64%) whereas the disoriented participants were lost for over 30

Table 13.1

*Aspects of the Participant's Wayfinding Experiences: Non-disoriented*

Environment Type (n = 14)			Mode of Travel (n = 14)			Time Spent Lost (n = 14)	
Urban	Rural	Suburban/ Campus	Walk	Drive	Other	< 30	> 30
21.43%	7.14%	71.43%	50.00%	50.00%	0.00%	71.43%	28.57%
Time of Day (n = 14)							
Day		Night					
64.29%		35.71%					

Table 13.2

*Percentage of Participants Reporting Perceived Threat/Safety Concerns and Skill Issues*

Feelings and Observations RE: Safety/Anxiety (n = 14)			Feelings and Observations RE: Skill Issues (n = 14)		
feeling afraid	thinking about safety	environmental characteristics re: safety	frustrated with obstacles/ choices	questioning ability	confusion re: environmental characteristics
21.43%	21.43%	21.43%	57.14%	50.00%	78.57%

Note: Percentages do not add up to 100%: Non-mutually exclusive categories.

Table 13.3

*Percentage of Participants Who Reported Actions Taken to No Longer Be Lost, Reported Attempts to Look for Help from Unknown Persons, and Information Regarding Why They Approached Unknown Persons*

Behavior: how they were no longer lost (n = 14)				Approaching Unknown Person (n = 3)	
working it out alone	contacting known person (calling)	contacting unknown person	looking for helpful opportunities	competent appearance	safe appearance
42.86%	35.71%	21.43%	35.71%	66.67%	0.00%

Note: Percentages do not add up to 100%: Non-mutually exclusive categories.

Table 14.1

*Aspects of the Participant's Wayfinding Experiences: Disoriented*

Environment Type (n = 23)			Mode of Travel (n = 23)			Time Spent Lost (n = 23)	
Urban	Rural	Suburban/ Campus	Walk	Drive	Other	< 30	> 30
34.78%	26.09%	39.13%	47.83%	47.83%	4.35%	39.13%	60.87%
Time of Day (n = 23)							
Day	Night						
69.57%	30.43%						

Table 14.2

*Percentage of Participants Reporting Perceived Threat/Safety Concerns and Skill Issues*

Feelings and Observations RE: Safety/Anxiety (n = 23)			Feelings and Observations RE: Skill Issues (n = 23)		
feeling afraid	thinking about safety	environmental characteristics re: safety	frustrated with obstacles/ choices	questioning ability	confusion re: environmental characteristics
52.17%	39.13%	30.43%	82.61%	60.87%	69.57%

Note: Percentages do not add up to 100%: Non-mutually exclusive categories.

Table 14.3

*Percentage of Participants Who Reported Actions Taken to No Longer Be Lost, Reported Attempts to Look for Help from Unknown Persons, and Information Regarding Why They Approached Unknown Persons*

Behavior: how they were no longer lost (n = 23)				Approaching Unknown Person (n = 9)	
Working it out alone	contacting known person (calling)	contacting unknown person	looking for helpful opportunities	competent appearance	safe appearance
30.43%	30.43%	39.13%	56.52%	44.44%	33.33%

Note: Percentages do not add up to 100%: Non-mutually exclusive categories.

minutes (61%). Both groups were more likely to be lost during the day than during the night. In terms of their thoughts, the disoriented participants were more likely to express thoughts about safety/anxiety than the non-disoriented participants, especially thoughts of being afraid (52% vs. 21%). In the non-disoriented group, thoughts about their own skills were more likely to focus on confusion about environmental characteristics (79%) whereas in the disoriented group they focused on being frustrated with obstacles or their own choices (83%). In terms of behavior, participants in the non-disoriented group tended to work it out alone (43%) whereas the disoriented group looked for helpful opportunities such as looking for someone who could provide directions (57%). Finally, and surprisingly, the disoriented participants were more likely to contact an unknown person for help (39%) compared to the non-disoriented group (21%). The three non-disoriented participants who asked for help from strangers chose them for their competent appearance; none mentioned their safe appearance. The nine disoriented participants were almost equally likely to approach a person based on his/her competent appearance and his/her safe appearance.

Finally, I had some exploratory questions regarding the participants who were willing to approach strangers. Using information from the demographics form I expected to see shared characteristics between the respondents and the reported direction givers, representing elements of in-group preference. For example, I reasoned that participants may have preferred to ask individuals of the same gender, age bracket, or ethnicity for directions. However, of the 52 participants, only 14 (9 females and 5 males) reported having approached a stranger for directions, the majority preferred to either work things out on their own or to find directions from a familiar individual. Of those fourteen participants, only four reported asking someone of the

same gender (female-female pairings). Five approached someone of a similar age bracket, meaning someone in their twenties rather than middle aged and older, as all of the participants were in their late teens or early twenties. Further, seven approached someone of the same ethnicity (six Caucasian-Caucasian pairings and one African American- African American pairing) which was unsurprising considering the majority of the participants were Caucasian. As mentioned earlier, 43% of these 14 participants made comments as to the individual's competent appearance, 21% made comments as to the individual's safe appearance, and 57% made other comments, such as the individual not looking too busy or being physically attractive.

The small number of observations, as well as the unknown demographic characteristics of the pool of strangers being asked, limits what can be concluded about the matching hypothesis. In fact, there is indication that the need to find one's way is more important than finding someone like him/herself. One participant went so far as to give us a description of who their ideal person to ask for directions would be: "not homeless, 20+ age, white, nice car, doesn't want to kill me." The description that he/she gave of the person he/she actually got directions from was: "black, uneducated, 40+ age." The participant was Caucasian and appeared to feel more comfortable approaching other Caucasian strangers. Nonetheless, the participant approached someone who did not fit the ideal in an attempt to find his/her way.

As to why the participants felt that they could approach the specific stranger they did, participants made statements about the person's: competent appearance ("probably knew the area well", "seemed from there"); safe appearance ("seemed less threatening", "looked nice", "seemed friendly"); and some other less classifiable statements ("didn't seem busy", "they were sexy"). One could argue that the statements referring to a stranger's competent appearance

reflect the wayfinder's own inadequate sense of direction (one questioning their own ability to navigate would value a helper's competency), just as one could argue that the statements about the stranger's safe appearance reflect the wayfinder's own anxiety (one feeling anxious navigating would value the relief of finding a helper whose safe or friendly appearance helps reduce that anxiety). The results from the analysis of disoriented and non-disoriented participants appear to support this argument. Those who were less disoriented preferred to ask someone who appeared competent whereas those who were more disoriented sought help from someone who was safe-looking and competent.

So far all of these results have been descriptive only, giving us an indication of trends specifically regarding the sample. Attempts were made at conducting inferential statistics with the data; however, having coded the essays categorically limited the analyses to less powerful non-parametric statistics. Further, although one-way chi-squares could be conducted on the situational aspects and behaviors, the thoughts about anxiety and ability categories were not mutually exclusive, violating an important assumption of the chi-square analyses. The only significant results from these analyses were that being lost or disoriented seems to be associated with the type of environment and time of day. People tend to become lost or disoriented on campus or in suburban environments compared to rural environments, and they tend to get lost more often during daytime than at nighttime (Table 15). Two-way chi-squares could be conducted in order to look for gender differences or differences across the disoriented and non-disoriented participants; however some of the analyses violated another assumption of the chi-square analyses in that some of the expected value cells contained values less than 5. The power analysis run prior to collecting data had only accounted for looking at one-way chi-squares, and

unfortunately there were not enough responses collected to adequately explore all of the two-way chi-squares possible. The results from these analyses involving gender and level of disorientation are reported in Tables 16 and 17. There were no significant differences across gender or the disoriented and non-disoriented participants (in those analyses which could be run without violating the assumptions of chi-square analyses).

Table 15

*Goodness of Fit Chi-Squares for Experiment 3*

	Expected Values	Observed Values	Chi-Square	P Value	Phi Coefficient
Urban <sup>AB</sup>	17.3	15	13.19	.001	.50
Rural <sup>A</sup>	17.3	8			
Suburban/Campus <sup>B</sup>	17.3	29			
Walking	25.5	24	.18	.67	.06
Driving	25.5	27			
More than 30 min.	26	20	2.77	.10	.23
Less than 30 min.	26	32			
Day	26	37	9.31	.002	.42
Night	26	15			
Alone	17.3	21	1.42	.49	.17
Known	17.3	17			
Unknown	17.3	14			

Table 16

*Chi Squares for Not Disoriented vs. Disoriented in Experiment 3*

	Expected Value Women	Observed Value Women	Expected Value Men	Observed Value Men	Chi-Square	P Value	Phi Coefficient
Urban	9.5	8	5.5	7	N/A	N/A	N/A
Rural	5.1	6	2.9	2			
Suburban/campus	18.4	19	10.6	10			
Walking	15.1	16	8.9	8	.30	.59	.08
Driving	16.9	16	10.1	11			
More than 30 min.	20.3	18	11.7	14	1.87	.17	.19
Less than 30 min.	12.7	15	7.3	5			
Day	23.5	23	13.5	14	.09	.76	.04
Night	9.5	10	5.5	5			
Afraid	14.0/19.0*	15/18*	8.0/11.0*	7/12*	.37	.55	.08
Safety	10.8/22.2*	13/20*	6.2/12.8*	4/15*	1.84	.18	.19
Env. Safety	9.5/23.5*	12/21*	5.5/13.5*	3/16*	2.49	.12	.22
Frustrated	24.8/8.2*	24/9*	14.2/4.8*	15/4*	N/A	N/A	N/A
Ability	17.8/15.2*	16/17*	10.2/8.8*	12/7*	1.05	.31	.14
Confusion	20.9/12.1*	19/14*	12.1/6.9*	14/5*	1.35	.25	.14
Alone	13.3	12	7.7	9	.74	.69	.12
Known	10.8	12	6.2	5			
Unknown	8.9	9	5.1	5			

\*(having reported the thoughts/not reported the thoughts)

Table 17

*Chi Squares of Gender Differences for Experiment 3*

	Expected Value Women	Observed Value Women	Expected Value Men	Observed Value Men	Chi-Square	P Value	Phi Coefficient
Urban	9.5	8	5.5	7	N/A	N/A	N/A
Rural	5.1	6	2.9	2			
Suburban/campus	18.4	19	10.6	10			
Walking	15.1	16	8.9	8	.30	.59	.08
Driving	16.9	16	10.1	11			
More than 30 min.	20.3	18	11.7	14	1.87	.17	.19
Less than 30 min.	12.7	15	7.3	5			
Day	23.5	23	13.5	14	.09	.76	.04
Night	9.5	10	5.5	5			
Afraid	14.0/19.0*	15/18*	8.0/11.0*	7/12*	.37	.55	.08
Safety	10.8/22.2*	13/20*	6.2/12.8*	4/15*	1.84	.18	.19
Env. Safety	9.5/23.5*	12/21*	5.5/13.5*	3/16*	2.49	.12	.22
Frustrated	24.8/8.2*	24/9*	14.2/4.8*	15/4*	N/A	N/A	N/A
Ability	17.8/15.2*	16/17*	10.2/8.8*	12/7*	1.05	.31	.14
Confusion	20.9/12.1*	19/14*	12.1/6.9*	14/5*	1.35	.25	.14
Alone	13.3	12	7.7	9	.74	.69	.12
Known	10.8	12	6.2	5			
Unknown	8.9	9	5.1	5			

\*(having reported the thoughts/not reported the thoughts)

## 17. STUDY 3 DISCUSSION

One of the main purposes for this third study was to provide a real-world, experience-based context to the first two studies. In addition, this study acted as a bridge between two very different literatures. In the spatial cognition literature the methods are typically experimental in nature, using survey measures and designed wayfinding tasks. The geography literature on navigational experiences is predominated by qualitative explorations of real world descriptions and personal histories. Part of making this connection viable is seeing how the variables being measured in the spatial cognitive literature by researchers' surveys relate to behaviors and thought processes which actually occur in the environment. I wanted to connect the concept of sense of direction to statements about one's own orienteering ability, concerns about environmental complexity, and frustration at botched navigational decisions and other obstacles made by real people reporting actual experiences. The results from the follow-up analysis of disoriented and non-disoriented participants provide evidence that they are connected. If one uses extent of disorientation as a proxy for sense of direction, those with higher sense of direction (i.e., the non-disoriented group) are more likely to be frustrated with confusing characteristics of the environment compared to those with low sense of direction (i.e., the disoriented group), who tended to be frustrated with their own choices and skills.

It was important to connect the idea of anxiety (especially related to wayfinding) to statements about feeling afraid, considering one's own personal safety and the aspects of an environmental space affecting safety. Considering that 46% of the women made statements

about being afraid, compared to 37% of men, this finding follows the same flow of logic discussed in the geography literature, which emphasizes the dangers inherent in navigational experiences. Specifically, women need to be vigilant in spatial arenas due to previous negative encounters and the common perceptions that women are more vulnerable in wayfinding situations (Koskela, 1999; Wesley & Gaarder, 2004). Strangely, while 94% of the women also made statements related to worrying about their own sense of direction, 100% of the men did as well. This seems contrary to the previous findings, and the results of experiment 1, which have shown that women tend to self report having lower sense of direction (Hegarty, et al., 2006; McKeen & Roskos-Ewoldsen, 2007; Montello, Lovelace, Golledge, & Self, 1999). Perhaps a likert scale question on one's own sense of direction during the situation described in the essay would have revealed gender differences.

Among the participants who had approached strangers, I expected to see some elements of in-group characteristics shared between the participants and the approached person. That would have been in line with the social psychology research on helping behavior, which frequently discusses how important in-group membership and the capacity for empathetic connections are for successful cooperative social interactions (Sturmer, Snyder, Kropp, & Siem, 2006). Unfortunately, I did not have as many observations of participants having approached strangers as I would have liked. From what little information I had for comparison across the participants and the person who they approached, four out of the fourteen interactions were gender matched, five out of the ten had a basic age cohort matching, and seven out of the fourteen were ethnically matched. However, these results are difficult to interpret because I do not know the base rates of gender and/or race in the environments.

In reality, the results of this study are extremely limited. Few of the inferential statistics were functional, providing only minimal conclusions that being lost or disoriented seems associated with population density (being in a campus or suburban environment vs. rural or urban environments) and the time of day (day vs. night). I had not conducted adequate power analyses prior to collecting data to ensure that my sample size would be sufficient for the statistical exploration desired. Additionally allowing some of the categories to be non-mutually exclusive limited my capacity with even the one-way chi-squares. Once again the sample of young and inexperienced participants questions the generalizability of these results as well. Many essays were about being lost on campus, so there was limited diversity in essay content. This study would likely have been more useful as a pilot study meant to help flush out hypotheses and create manipulation specific dependent variables for the project as opposed to being a featured study.

## 18. GENERAL DISCUSSION

In experiment 1, sense of direction, gender, and the described environment variable (threatening vs. non-threatening) predicted perceived threat for the walking vignette whereas general anxiety predicted perceived threat for the driving vignette. Participants confident in their wayfinding ability perceived less threat than those with a lower sense of direction with the walking vignettes. Men perceived less threat from the walking vignettes than women. Yet with the driving vignettes general anxiety was the only predictor of perceived threat. As stated earlier, sense of direction may have been more prominent in the participants' thoughts in a walking environment because they are preoccupied with attempting to find their way and not allowing themselves to monitor their anxious feelings. One's gender may have also been in the minds of the female participants as, can be seen from the geography literature, women typically are viewed as more vulnerable while moving through spaces, especially when on foot. Perhaps advancements in electronic navigational technology decrease the necessity for the driving wayfinder to keep one's sense of direction or vulnerabilities related to gender in mind, allowing for focus on one's feelings of anxiety.

There were no instances of individuals citing the use of GPS devices in the essays in experiment 3; as they become standard in vehicles they are likely to significantly impact wayfinding in the future. Hand-held GPS devices and internet enabled phones capable of pulling up interactive maps could begin disassociating wayfinding related anxiety from poor navigational ability and gender concerns. The perceived importance of one's sense of direction

may seem negligible to the anxious aspects of feeling disoriented when these electronic tools are available. That is not to suggest that these devices would completely alleviate anxiety altogether during navigation tasks, especially regarding the discomfort one feels when lost or disoriented. Anxieties are difficult conditioned responses to extinguish (Waters, Henry, Neumann, 2009). The purpose of these navigational tools is to keep one from becoming lost or disoriented in the first place. However, people sometimes ignore preplanned routes with GPS tracking by spontaneously altering travel plans while wayfinding. Papinski, Scott, and Doherty (2009) compared individuals' GPS planned routes versus observed routes with regard to their home-to-work commutes, a navigation activity typically thought of as inflexible because of its routine nature. Even with their small sample of 31 participants, one in five individuals spontaneously changed their routes within a two day measurement period. On average, these altered routes increased the distance traveled by 44%, and were created for diverse reasons (e.g., traffic congestions, new route exploration). Perhaps the people most likely to deviate were those with high sense of direction, but this variable was not measured in this GPS study. Otherwise, one would expect that spontaneous changes would lead to anxiety-provoking experiences, as ignoring the GPS route decreases the tool's utility of keeping one from getting lost.

Even when individuals are paying attention to their GPS devices, it could be negatively influencing their ability to acquire spatial knowledge about an environment and produce poorer wayfinding performance compared to other forms of navigational aid. Ishikawa, Fujiwara, Imai, and Okabe (2008) had 66 participants, divided into three groups, engaging in six real-world wayfinding tasks; walking complex courses through a residential environment in Kashiwa, Chiba, Japan. One group had to travel the six routes with cell phones equipped with GPS-

navigational devices displaying the wayfinders' location and their progression along a programmed path to the destination, updated in real-time. The second group had to travel the six routes with maps displaying the wayfinder's starting location and the destination, with no specific paths marked. The third group of wayfinders were led by an experimenter along each of the six paths, returned to the starting points by a circuitous route and then asked to retrace the paths on their own. Their wayfinding behavior was measured by how quickly they reached the destination, how frequently they needed to make stops lasting longer than 30 seconds in order to re-orient themselves, and the distance traveled before reaching the destination. Their spatially acquired knowledge of the environment was measured by pointing in the direction of each path's origin once at the destination, and analyzing their sketched maps of the environment after having completed the tasks. Additionally, each participant was asked to rate on a likert scale how difficult it was to complete the wayfinding task. Overall, the GPS-based navigation fared poorly. GPS-based wayfinders made more stops, travelled longer distances, and took more time to reach the destinations compared to the map and direct-experience groups. Their direction estimates also had greater error, their sketch maps were decidedly incomplete (frequently omitting correct direction changes), and the GPS participants reported the tasks were more difficult compared to the map group and guided group ratings.

The researchers argued that the GPS-based navigational devices forced the participants to focus on the environment in a piecemeal fashion. Only a small portion of the surrounding area could be displayed with the moving icon representing the wayfinder. There was little opportunity for the participant to integrate their position within a larger, more holistic-framework of the environment. The participants given maps or a guided tour were more likely to view the

environments at a distal level, constantly updating their surroundings as related to their own changing positions. Similar spatial information deficiencies have also been noted in studies researching auditory guidance systems meant to decrease the demand on visual processes, though some improvements have been seen when the verbal messages contain greater amounts of landmark information (Reagan & Baldwin, 2006). These results seem particularly unsettling should navigating with a GPS device available also decrease one's sense of direction. Not acquiring the survey information from one's surroundings coupled with a decreased need for good navigational abilities in the first place could lead to unfortunate situations. In any case, more research needs to be conducted to further clarify the relationship between sense of direction and anxiety, and anxiety and gender, as these new technologies become more available and used more frequently in daily wayfinding activities.

The nature of spatial anxiety and general anxiety took on a level of focus admittedly not originally planned for in the initial construction of this project. However, as the issues regarding these two variables required reflection and further analysis, a number of interesting ideas arose. In experiment 1, people higher in general anxiety were lower in sense of direction and perceived greater amounts of threat in the driving vignettes, compared to people lower in general anxiety. Spatial anxiety did not relate to any variable. In experiment 2, greater levels of general anxiety predicted a lower likelihood of asking a stranger for directions. Again, spatial anxiety was not related to any variable. Although it appears that spatial anxiety and general anxiety explain partially overlapping variability, general anxiety seems to be far more important than spatial anxiety in a wayfinding situation. It is clear that future research on wayfinding should

incorporate general anxiety instead of, or in addition to, spatial anxiety. At the very least, this finding needs to be replicated beyond the studies reported here.

In experiment 1, it is clear that people who understand their own poor ability to navigate are more likely to feel anxious (lower sense of direction predicted higher levels of general anxiety). This partially replicates previous research in which higher levels of sense of direction are associated with lower levels of *spatial* anxiety (McKeen & Roskos-Ewoldsen, 2007). Given the correlational nature of this outcome, it is difficult to say whether anxiety causes a lower sense of direction, perhaps through decreased availability of working memory for learning environmental information. Perhaps a lower sense of direction, whether due to inherent deficits or lack of exposure to the environment, causes higher anxiety. Future research of an experimental or longitudinal nature is needed to answer this question.

Experiment 1 also showed the expected gender differences in (general) anxiety regarding wayfinding (women reporting higher levels of general anxiety compared to men). Additionally, I found the expected gender difference for sense of direction (men reliably reported higher levels of sense of direction compared to women). Women also tend to report higher levels of spatial anxiety compared to men (Lawton & Kallai, 2002; McKeen & Roskos-Ewoldsen, 2007), but this result was not found here. In this current study, general anxiety was a more functional tool compared with attempting to measure spatial anxiety. In a way, the gender differences in general anxiety in a wayfinding situation (rather than spatial anxiety per se) fit with the findings from the geography literature. In the geographical literature, females report anxious, detrimentally emotional reactions to navigational activities, seeing environments as though they were spaces where females are historically victimized (Pain, 1997). These issues frequently engender

increased awareness of vulnerability and increased vigilance among female participants (Wesley & Gaarder, 2004).

The lack of gender differences in spatial anxiety could be due to differences in the samples of participants across the current and other studies. Lawton and Kallai (2002) tested participants of varying age groups and both genders in a large mid-western city in the US and a similarly sized city in Hungary. The geographical studies came from women of many ages in Europe (Koskela, 1999; Pain, 1997) and the US (Wesley & Gaarder, 2004). However, my earlier results were drawn from the Psychology 101 subject pool at the University of Alabama, the same pool as the current experiments, barely three years ago (McKeen & Roskos-Ewoldsen, 2007). So if not age, if not region, if not awareness of vulnerability, what makes the observations regarding spatial anxiety so unique? The results from this project suggest that spatial anxiety lacks adequate construct validity. Both aspects of these descriptive variables, spatial and general anxiety, need to be measured when considering the anxiety people have when engaging in wayfinding activities.

What is clear at the moment is that general anxiety can predict willingness to ask strangers for directions in a wayfinding situation, but not known individuals. This clarifies my earlier results (McKeen & Roskos-Ewoldsen, 2007), which suggested that spatially anxious participants were less willing to engage in social wayfinding interactions than non-spatially anxious participants, neither giving directions (as predicted) nor asking for directions (not predicted). Why did the spatially anxious participants from my earlier research report being so unlikely to engage in direction seeking behavior? Given the current results, the answer is because I did not differentiate between strangers and familiar persons. Anxiety might not

immobilize one from asking for directions; rather, it increases one's desire to get directions under the right circumstances: from someone familiar. Additionally the results of experiment 2 revealed how the likelihood of asking for directions and the status of the potential asked person (stranger vs. acquaintance) interacts with gender. The male participants were less likely to ask an acquaintance for directions than women, while the women were less likely to ask a stranger for directions than men. The explanation for this interaction is likely that men want to avoid appearing navigationally inferior in front of someone they know and women prefer to seek the empathetic interaction they are more likely to receive from an acquaintance compared to a stranger.

In the future, it would be good to test these ideas in a different experimental setting. Men and women could be measured on their sense of direction and some question(s) meant to measure how integral their wayfinding ability is to their self image. All of the participants would be told that they are going to participate in a very difficult, real-world wayfinding task somewhere off-site (perhaps say they would be driven to a remote, complex neighborhood or a recreationally built maze) where their wayfinding ability will be measured exhaustively (e.g., time to completion, number of incorrect turns, an origin location pointing task). They could even be shown a complex map of the environment they are supposedly going to be navigating and told they will have only three minutes to study the map prior to beginning the wayfinding task. The participants would be told that, for their comfort, it had been decided that the wayfinding task would be performed in pairs. They could be informed that they would be paired with a random fellow participant, but they could indicate their preferences for an acquaintance or a stranger. Considering the stereotypical perception that orienteering ability is a masculine trait and

generally considered central to men's sense of self one would expect men would be more likely to choose a stranger to avoid appearing helpless or incompetent to someone they knew.

Additionally, women could be expected to request an acquaintance in order to allay anxiety by securing the help of a supportive, empathetic partner.

From the retrospective analysis there were several interesting results. The participants paid attention to contextual cues in environmental spaces regarding safety issues; that is evident from the percentages of such observations. However, it was not the majority of participants. Perhaps the participants used in this sample, young undergraduate students, have not yet had the experiences of perceived vulnerability in wayfinding situations. Reading threatening scenarios had no impact on willingness to approach strangers in experiment 2. Why were there no behavioral differences based on contextual threat? It could be that the manipulation used was not functionally strong enough. Another reason for not finding a relation between perceived threat and willingness to approach strangers may be because environmental threat is a situational variable, whereas sense of direction and general anxiety are trait variables. Situational cues are always in flux, changing rapidly, arguably much more so than these trait variables are. Suppose one is sitting in his/her vehicle in a gas station parking lot in the late evening hours, contemplating entering the store for directions. Imagine the environment appearing less than hospitable: intimidating groups of people loitering, poor lighting, and high crime rate in the area. One cannot remain in the car, hoping one's tendency to be anxious in wayfinding situations will simply dissipate or one's sense of direction will magically increase. However, the situational variables can change drastically from moment to moment. More light may be introduced to the area from another car pulling into the station, the loitering groups may disperse to other

locations, or a passing patrol vehicle may stop at the gas station. These windows of opportunity for approaching someone for directions may not change one's sense of direction or anxiety, but they will provide a moment when one feels more comfortable asking for directions, even in a threatening environment.

In future studies, to better understand the role of perceived threat in the likelihood of approaching strangers for directions, it would be good to ask participants to verbalize their thoughts while looking for a prospective direction-giver during a real world wayfinding task. Their discourse could be coded for the strategies being used as they navigated the environment, similar to the study by Kato and Takeuchi (2003). In the Kato and Takeuchi study, participants were asked to rely on their own skills, and getting help from another person was not allowed because the researchers were specifically interested in gaining an understanding of all the strategies the participants were capable of using to find their way on their own. Future similar studies that allow participants to ask for directions will likely provide a significant increase in information about help-seeking, compared to the current study in which essays were written from memory. More importantly, this approach could provide clues as to how anxiety is sometimes overcome or negated as someone engages in asking a stranger for directions.

## 19. CONCLUSIONS

Due to the limitations created by the methodologies employed and mistakes made during experiment construction, the contribution of this research to the wayfinding literature is limited. However, there are elements that may provide stepping stones for research material in the future. I have empirical evidence supporting the partial overlapping relationship of spatial anxiety and general anxiety. Future researchers interested in measuring nervous or fearful feelings associated with wayfinding activities need to be aware of how one's tendency to be anxious in general and one's likelihood to feel anxious when navigating are intertwined.

Also, thoughts about sense of direction, feelings of anxiety, and environmental cues indicating safety or threat should be included in participant recollections of wayfinding experiences from the past. Based on the current studies, sense of direction and gender predict perceived threat in a walking environment while general anxiety predicts perceived threat in a driving environment. However, I was unable to document a relationship between perceived threat and direction seeking behavior. I believe that this variable's role in wayfinding situations needs to be examined under greater scrutiny, the same way that the likelihood of engaging in social wayfinding was analyzed by strangers versus acquaintances. While higher levels of general anxiety predicted less desire to ask for directions from strangers, it did not predict likelihood of asking for directions from a known individual. Having clarified this relationship between anxiety and one's willingness to engage in social wayfinding interactions, and looking at the gender differences found regarding likelihood to ask for directions from strangers vs.

familiar people, I hope to expand on this base with research that will build an understanding of social wayfinding strategies, including the factors that influence their implementation.

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## APPENDIX A

### Demographic Information

The following questions are simply to help us properly analyze the data and to have an appropriate amount of background information.

1. What is your sex?

- 1 Male
- 2 Female

2. How old are you now? \_\_\_\_\_ years

- 1 18 years or younger
- 2 19 to 20 years
- 3 21 to 22 years
- 4 23 to 24 years
- 5 25 to 26 years and on

3. How would you describe your racial or ethnic group?

- 1 White/Caucasian
- 2 Black, African-American
- 3 Native American
- 4 Hispanic, Latino
- 5 Asian/Pacific Islander
- 6 Other
- 7 Multi-racial
- 8 Refused

## APPENDIX B

### Santa Barbara Sense of Direction Scale

(adapted from M. Hegarty, A.E. Richardson, D.R. Montello, K. Lovelace & I. Subbiah, 2002)

This questionnaire consists of several statements about your spatial and navigational abilities, preferences, and experiences. After each statement, you should circle a number to indicate your level of agreement with the statement. Circle one if you strongly agree that the statement applies to you; seven if you strongly disagree or some number in between if your agreement is intermediate. Circle four if you neither agree nor disagree.

1. I am very good at giving directions.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

2. I have a poor memory for where I left things.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

3. I am very good at judging distances.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

4. My “sense of direction” is very good.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

5. I tend to think of my environment in terms of cardinal directions (N,S,E,W).

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

6. I very easily get lost in a new city.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

7. I enjoy reading maps.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

8. I have trouble understanding directions.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

9. I am very good at reading maps.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

10. I don't remember routes very well while riding as a passenger in a car.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

11. I don't enjoy giving directions.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

12. It's not important to me to know where I am.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

13. I usually let someone else do the navigational planning for long trips.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

14. I can usually remember a new route after I have traveled it only once.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

15. I don't have a very good "mental map" of my environment.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

## APPENDIX C

### Spatial Anxiety Scale (adapted from C.A. Lawton, 1994)

The following sentences describe a series of situations you could find yourself in, or statements which could be made about you. Rate the level of anxiety you think you would feel in each of the situations. Use the following scale to rate your level of anxiety provided with each statement. Select a one if you think you would experience anxiety "not at all"; select four if you think you would experience "a fair amount" of anxiety, and so on. Rate the level of agreement you feel about each general description statement as far as how well it applies to you. Use the following scale to rate your level of agreement provided after each statement. Select a one if you think the sentence describes you "not at all"; select four if you think it describes you "a fair amount", and so on.

#### LEVEL OF ANXIETY:

1	2	3	4	5	6	7
"Not at all"			"A fair amount"			"Very much"

1. \_\_\_ Finding your way to an appointment in an area of a city or town with which you are not familiar.
2. \_\_\_ Finding your way out of a complex arrangement of offices that you have visited for the first time.
3. \_\_\_ Finding your way around in an unfamiliar mall.
4. \_\_\_ Finding your way back to a familiar area after realizing you have made a wrong turn and become lost while driving.
5. \_\_\_ Pointing in the direction of a place outside that someone wants to get to and has asked you for directions, when you are in a windowless room.
6. \_\_\_ Locating your car in a very large parking lot or parking garage.
7. \_\_\_ Leaving a store that you have been to for the first time and deciding which way to turn to get to a destination.
8. \_\_\_ Trying a new route that you think will be a shortcut without the benefit of a map.
9. \_\_\_ Using maps to find your way.

Questions adapted from Neuroticism Scale of Big Five

10. \_\_\_\_ You are depressed, blue.
11. \_\_\_\_ You are relaxed, and handle stress well.
12. \_\_\_\_ You can be tense.
13. \_\_\_\_ You worry a lot.
14. \_\_\_\_ You are emotionally stable, not easily upset.
15. \_\_\_\_ You can be moody.
16. \_\_\_\_ You remain calm in tense situations.
17. \_\_\_\_ You get nervous easily.

## APPENDIX D

### Perceived Threat on Vignettes

Earlier you had read two descriptions of situations you might find yourself in where you needed to find your way somewhere. Remembering those situations rate them on how threatened you would feel if you were in those situations. You will use a scale of one to seven, one being “*Not at All Threatening*” and seven being “*Extremely Threatening*.” After which point, you will move on to the next part of the survey.

How threatening was the walking situation?

<i>Not At All Threatening</i>	1	2	3	4	5	6	7	<i>Extremely Threatening</i>
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How threatening was the driving situation?

<i>Not At All Threatening</i>	1	2	3	4	5	6	7	<i>Extremely Threatening</i>
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## APPENDIX E

### Social Wayfinding Vignettes

Read the following vignettes, doing your best to immerse yourself within the situations described. Once you have completed the vignettes you will be asked to rate them on how threatened you would feel if you were in this situation. You will rate each scenario on a scale of one to seven, one being “*Not at All Threatening*” and seven being “*Extremely Threatening*.” After which point, you will move on to the next part of the survey.

#### Threatening Vignettes:

It is 3:00 am and you are alone on campus having trouble finding your way back to your dorm or where you had parked your vehicle. Keeping as best you can to the well lit walkways, the long shadows cast by the buildings create large areas of total darkness. There is virtually no one around; at least no one you can see. In the back of your mind you can remember the warnings given by your parents and friends to stay safe and out of dangerous situations. Suddenly you also recall the campus wide email alerts warning students against late night assaults and robberies occurring on or near campus last year. You would call one of your friends to help you feel more comfortable and help guide you to where you need to be, but your cell phone has run out of power. Just as you consider heading back the way you came you notice someone walking nearby you could ask for directions.

It is very late when you finally make your way out of the car rental place as you leave the airport. You have never been in this city before and are in town for a job interview. Keeping to the major streets and highways you regret not having taken the time to get good directions to your hotel. Some of the exits and smaller roads seem less well lit, and it’s hard to know which neighborhoods could be considered unfriendly in this new environment. Nevertheless, you pull off on an exit so that you can get your bearings. It’s a little spooky because there is very little activity around you, and you hear sirens in the background. You remember having heard some chilling stories from a friend that business travelers are frequent victims of crime, vulnerable while alone and easy to target by local criminals. Police sirens and triggered alarms sound in the distance as you pull off at a random exit to help get your bearings. At a stop light you notice someone waiting at a bus stop you could ask for directions.

### Non-threatening Vignettes:

It is 1:30 pm and you are alone on campus having trouble finding your way back to your dorm or where you had parked your vehicle. Keeping to what could be somewhat familiar walkways, the buildings seem less recognizable from this direction and you aren't sure that this is the way you came before. In the back of your mind you can remember the warnings given by your parents and friends to pay attention, as they know how learning the complex campus can be difficult. It's very easy to get lost and confused, causing you to be late, appearing careless; which is not the impression you want to make. You would call one of your friends to help you feel more comfortable and help guide you to where you need to be, but they are all in their own classes at this time of day. Just as you consider heading back the way you came you notice someone walking nearby you could ask for directions.

It is a warm and pleasant afternoon when you finally make your way out of the car rental place as you leave the airport. You have never been in this city before and are in town for a job interview. Keeping to the major streets and highways you regret not having taken the time to get good directions to your hotel, especially since it can be easy to get turned around in new places. Some of the exits and smaller roads have signs that are hard to read, and it's impossible to tell which ways are going to have the least traffic or get you where you need to go quickly in this new environment. You remember having heard some stories from a friend that business travelers are frequent victims of not being able to find their way, arriving late to meetings, appearing disheveled and unorganized. At a stop light you notice someone waiting at a bus stop you could ask for directions.

## APPENDIX F

### Likelihood of Engaging in Social Wayfinding

This questionnaire consists of several statements about your willingness to engage in social interactions related to finding your way in an environment. After each statement, you should circle a number to indicate your level of agreement with the statement. Circle one if you strongly agree that the statement applies to you; seven if you strongly disagree, or some number in between if your agreement is intermediate. Circle four if you neither agree nor disagree.

1. I am comfortable giving directions to people I know.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

2. I am comfortable giving directions to strangers.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

3. I am comfortable asking for directions from people I know.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

4. I am comfortable asking for directions from strangers.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

5. I prefer to take someone with me when I am going somewhere new.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

6. I am comfortable going alone when I am going somewhere new.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

7. After dark, I am comfortable giving directions to people I know.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

8. After dark, I am comfortable giving directions to strangers.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

9. During the day, I am comfortable giving directions to people I know.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

10. During the day, I am comfortable giving directions to strangers.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

11. After dark, I am comfortable asking for directions from people I know.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

12. After dark, I am comfortable asking for directions from strangers.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

13. During the day, I am comfortable asking for directions from people I know.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

14. During the day, I am comfortable asking for directions from strangers.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

15. I am comfortable asking for directions from males.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

16. I am comfortable giving directions to males.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

17. I am comfortable asking for directions from females.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

18. I am comfortable giving directions to females.

*Strongly Disagree*    1    2    3    4    5    6    7    *Strongly Agree*

## APPENDIX G

### Wayfinding Experience Essay

Please use this sheet to give us a detailed description of the last time you were lost or disoriented by yourself. Make sure that you include information that answers the following questions: How were you travelling? (walking, driving, etc.) What kind of place was it? What aspects of the situation were you paying attention too? What were you feeling? What were your thoughts? What did you do to make yourself no longer lost?

Please indicate the level of disorientation you considered yourself.

*Very Slightly*      1      2      3      4      5      6      7      *Completely Lost*  
*Disoriented*

Please use this space to describe in a paragraph the situation in which you were lost or disoriented:

To ensure we are capturing the necessary information, fill out these supplemental questions regarding the situation which you have just described in which you were disoriented or lost:

How were you travelling? (i.e., walking, driving, etc.)

How did you get lost? (i.e., wrong turn, wasn't paying attention, confusing environment, etc.)

What kind of place was it?

What time of day was it?

How long were you lost or disoriented? How much time did it take for you to find your way again?

What were you feeling? (i.e., worried, frustrated at yourself or your surroundings, helpless, anxious, angry at yourself or your surroundings, intimidated by the environment, etc.)

What were your thoughts? (i.e., my own abilities, my own safety, discomfort, hunger, etc.)

What did you do to make yourself no longer lost?

Did you look for someone to give you directions?

How many people did you see that you could have asked for directions?

If you approached someone for directions, describe that person; their age, appearance, gender, ethnicity, whatever you remembered about them:

Why do you think you chose to approach that person for directions, as opposed to another individual?



