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Gender, Spatial Learning Trials, and Object Recall.

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Gender, Spatial Learning Trials, and Object Recall

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ABSTRACT

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by

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Previous researchers have reported women doing better than men in object recall. The current study tested for gender differences in object recall over three memorization trials using gender neutral stimuli. Fifty men and 53 women viewed pictures of 60 objects (15 in each of four quadrants) for one minute, and then had three minutes to recall as many objects and locations as they could. This procedure was followed over three trials. Women performed better than men, and the difference increased across trials. Training was successful as participants recalled significantly more objects and locations on trial 3 than on trial 1. These results supported previous findings of superior object recall in women relative to men, but they also suggested that the gender difference is not only maintained, but also increases with additional learning opportunities. It was concluded that the gender difference favoring women is not vulnerable to additional learning trials.

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CHAPTER 1

INTRODUCTION

Gender differences in cognitive functioning have been studied from many different perspectives. Most psychological literature supports that there is a significant gender difference in memory favoring females (Casey, 1996; Kimura, 1999; Silverman & Eals, 1992; Stumpf, 1998). Traditionally it was believed that males possessed a superior ability in spatial recall. However, recent research has examined different types of spatial tasks and has demonstrated significant gender differences on different types of tasks. Some spatial tasks tend to favor females, while others favor males. Females have been shown to possess superior object recall (Kimura, 1993) and males to be superior in visual spatial tasks such as mental rotation, map reading, and way-finding (Lawton, 1994). Biological, evolutionary, and environmental theories will be reviewed to provide explanations for gender differences in memory.

Theoretical Background

The largest and most consistent gender difference favoring males has been found on mental rotation tasks (Casey, 1996; Kimura, 1999; Stumpf, 1998). Why this gender difference is most consistent is still being debated, partially because it is virtually impossible to evaluate biological predispositions independent of evolutionary and environmental theories. Contemporary theories have integrated new theoretical formulations with old ones.

Evolutionary Theory

There are two main evolutionary models of spatial differences. One is based on the mating system of mammals, and the other on the foraging and hunting concepts as conveyed in the hunter-gatherer theory (McBurney, Gaulin, Devineni, & Adams, 1997). Gaulin and Fitzgerald (1986) investigated an evolutionary hypothesis on sex differences in spatial ability. They focused their study on the mating systems of *Microtus pennsylvanicus* (meadow voles) and *M. pinetorum*, (pine voles) and their spatial maze performance. Meadow voles mate with many females and cover a large area for hunting purposes. It was hypothesized that due to their larger area of travel for hunting and mating, the male meadow voles would have a higher spatial ability. They found that male meadow voles possessed greater spatial ability than females. Pine voles, which have a much smaller range, needed double the training as the meadow voles to obtain similar results on the spatial tasks. Gaulin and Fitzgerald concluded that spatial ability did not depend necessarily on the sex of the animal but the type of mating and hunting system used by each sex and species.

Gaulin and Hoffman (1988) argued that spatial ability is determined by the navigational demands of the organism, which are different from species to species. Meadow voles travel greater distances for mating purposes than pine voles do, and therefore spatial skills correspond to their range area. It is difficult to apply this theory to modern day humans. Gaulin and Hoffman suggested that other factors such as environment and hormonal influences must be taken into account when considering spatial performance in humans.

Silverman and Eals (1992) suggested an alternative theory to mating strategies. They focused on spatial dimorphism in humans, labeling it the hunter-gatherer theory. During human evolution there was a pronounced division in labor between males and females. Males were primarily hunters and females were primarily gatherers. These differing tasks employ different spatial techniques. Males tracked and killed animals over a large area, while females stayed closer to the home, took care of the children, and foraged for edible plants. Silverman and Eals proposed that males and females developed superiority in different types of spatial skills in relation to their labor responsibilities.

They then tested their hypothesis by using spatial tasks that would employ either hunting or foraging techniques. Silverman and Eals attempted to measure object memory and location memory separately. The first task consisted of elements of mental rotation and space relation, which are used in hunting. As expected, males performed better. Next they used a foraging task in which participants were shown an array of objects for one minute. Then they were given another similar object array that had additional objects in it. Participants then crossed out the objects that were not previously there, therefore testing object memory. Then participants were shown another similar object array, but some of the objects were moved to a different location. Participants had to cross out objects that had been moved, testing for location memory. Again as expected, females significantly outperformed males. Another experiment was conducted by using an actual array of objects in a room, as opposed to a sheet of paper. Participants sat in a room with the objects present. They did not know that they would be asked to later try and recall as many objects as possible (incidental learning condition). Females scored significantly higher in memory location. Thus the hunter-gatherer model was supported. Females consistently outperformed males on object memory and location. They suggested that men and women process what is in their environment differently.

Eals and Silverman (1994) attempted to generate support for the hunter-gatherer theory by replicating their 1992 studies, only they used uncommon objects. This ruled out the use of verbal labels for the objects and withdrew any advantage to female participants. The results correlated positively with the results from their 1992 studies. However object memory with uncommon objects only approached significance. Females performed better in incidental learning conditions, and males performed better in directed learning conditions. Eals and Silverman suggested these differences were due to the attentional style of females. Through gathering techniques they paid closer attention to their immediate environment than did males, even without being directed to do so. Also a female disadvantage in a directed learning task would be their predisposition to attach verbal labels to the objects which may have hindered performance. Silverman et al. (2000) further supported their hunter-gatherer theory by mimicking a hunter oriented strategy by using way-finding tasks. They demonstrated that in naturalistic navigational tasks men outperformed women.

McGivern et al. (1998) also found female superiority in object memory. They suggested that in evolutionary terms, females developed a greater awareness for maternal matters. They developed a concern for caring and protecting offspring. McGivern et al. (1998) agreed with the Meyers-Levy hypothesis that females process information more comprehensively, taking in both significant and non-significant details. In comparison, males tend to be more selective in their attentional styles, focusing on what they deem is most relevant to their current task. Kimura (1999) suggested that women may have a disadvantage to spatial tasks such as the water level task because they are more field dependent than males, meaning they are more affected by the surrounding background. This supports the hunter-gatherer theory in that women pay more attention to details in their immediate environment than males do.

McBurney, Gaulin, Devineni, and Adams (1997) argued that standard spatial tasks are generally culturally biased in favor of males. For example, males generally perform significantly better than females on mental rotation tasks. Traditional tests like this employ thought processes that are used in hunting behavior. However, in a different spatially oriented task, as in the game Memory, females scored significantly higher than males. This result suggested to McBurney et al. that males and females have developed different spatial processes for survival. Daubbs, Chang, Strong, and Milun (1998) also supported the hunter-gatherer theory in that women performed better than men on an object location task and men performed better than women on a mental rotation and map skills task.

Biological Theory

Males and females are biologically different creatures. There may be many biological distinctions between the two sexes. However, cognitive differences are not as apparent as physical differences. Neurological studies have shown that there are sex differences in brain functioning (Kimura, 1992). Hamilton (1995) showed that different parts of the brain were used for two different spatial tasks. Males generally use more of their right hemispheres than females do on mental rotation tasks and also perform significantly better on these tasks. Overall, the left hemisphere has dominance on language oriented tasks and the right hemisphere dominance for spatially oriented tasks (Gaulin & Hoffman, 1988). McCourt, Mark, Radonovich, Willison, and Freeman (1997) noted that males typically perform better than females on tasks that focus on right hemispheric functions, such as visual and perceptual spatial tasks (i.e. mental rotation), while women typically perform better on left hemispheric tasks, such as tasks involving verbal skills.

However, Kimura (1992) indicated that females, like males, also rely more on their right hemisphere while engaged in performing mental rotation tasks (MRT). Additionally, when presented with a left hemispheric spatial task, males still tended to perform better, although not as consistently. There have been relatively consistent findings regarding left versus right visual hemispace, (Alexander, Packard, & Peterson, 2002). Alexander et al. found that both males and females remember peripheral objects better than central ones, that there was no sex difference in object identity presented in the left visual field, but that there was in object location. Females remembered more object locations in the right hemisphere. This result suggested a gender difference in hemispheric asymmetry. Duff and Hampson (2001) also found female superiority on a novel multitrial spatial working memory task. The task was akin to the game Memory, but they used 10 pairs of colored dots instead of pictures. Participants had three trials to match all 10 pairs as fast as they could with the least amount of errors as possible. Women took less time and made fewer errors overall. Differences in intelligence, attention, speed, and incidental memory did not account for the female dominance. Duff and Hampson suggested that men and women may process working memory differently.

One of the main drawbacks to the biological theory is that research across cultures has not consistently lead to gender differences on various spatial tasks. Feingold (1994) failed to find dependable evidence for either gender superiority on verbal, mathematical and spatial ability across six different nations. A criticism of this study was that recent data was not used and spatial measures were lumped into one category instead of being broken down into various spatial measures for different spatial tasks.

Lawton and Kallai (2002) examined gender and culture in way-finding strategies. Overall, men reported a greater preference for orientation strategies and women for route strategies regardless of culture. These findings replicated Lawton's (1994) study which used only American participants. According to Baenninger (as quoted by May, p. 521, 1997) "I think there are biologically based differences between men and women's directional sense, but I think a greater amount of variability between men's and women's performances – particularly for everyday spatial tasks is accounted for by experimental and motivational factors".

The sex chromosomes are the main genetic difference between males and females. Several researchers have thought that estrogens and androgens are the cause of initiating these differences in memory and spatial ability (Kimura, 1992). McCourt, Mark, Radonovich, Willison, and Freeman (1997) reported that there are performance differences in human females in various stages of their menstrual cycle. Participants had to complete the spatial task of pointing to the midsagittal plane, which is a typically left hemispheric oriented task (in which males generally perform better). Females in their luteal phase performed significantly better than those who were menstruating. McCourt et al. suggested these differences are due to a greater activation of both hemispheres during the luteal phase. This bilateral activation is not seen as prominently during the menstrual phase. Kimura (1992) discovered that women with high levels of testosterone performed better on certain spatial tasks than women who had lower levels on testosterone. Testosterone levels did not effect male performance significantly. Choi and Silverman (1996) suggested that estrogen, at high levels, may act as an inhibitor of spatial capabilities. Silverman and Phillips (1993) found significantly higher mental rotation scores for women who were in their menstrual period phase, during which estrogen levels are at their lowest. Silverman and Phillips suggested that the more difficult and abstract the spatial task, the more consistent the gender difference. They labeled the 3-D mental rotation task as being the most difficult because verbal fluency does not help the participant to reach the correct answer.

Silverman, Phillips, and Silverman (1996) tested the hormonal theory across cultures (Japanese and Canadians) with results similar to their 1993 study. Mental rotation showed a much larger gender difference than space relations; both favored males. Young and Wilson (1994) presented tasks (used by Kimura, 1992) that either males or females typically do better on. However Young and Wilson used prepubescent children as participants and found no significant gender differences. They concluded that different spatial tasks involve different brain structures and hormones. Moreover, they proposed that any gender differences in adult males and females are due mainly to hormonal changes following puberty. The biological and hormonal theories complement the evolutionary theory of sex segregated differences in spatial ability. Future research may more clearly define the relationship between biological and evolutionary theory.

Environmental Theory

Early theories of gender differences focused on socialization practices (Silverman & Phillips, 1993). If adults perform substantially better than children on spatial tasks it can be argued that experience plays a key role in superior spatial memory. Therefore spatial differences would be learned and not necessarily inherited. If a child is raised in an environment rich in spatially oriented tasks, it should be able to do better on spatial tests than a child who did not receive as much exposure to spatial tasks. Matthews (1986) revealed that at a young age boys possessed a greater awareness of space by recalling places further away than girls recalled. Matthews concluded that how children interact with their environment greatly influences their cognitive spatial abilities. Parents give boys more freedom to play and to travel (further from their homes) than they give girls (1986). Matthews also found that the older the children, the greater the spatial performance difference. Boys recalled more information from more distant locations and girls remembered more detailed information within a smaller radius of home. Matthews theorized that through socialization and gender role expectancies girls and boys develop different spatial skills.

Lawton (1994) hypothesized that childhood experience would help explain why there are gender differences in way-finding. Males tend to use route strategies, while females tend to use orientation strategies. Again, this difference may stem from greater restrictions of environmental exploration placed on girls. Lawton and Kallai (2002) confirmed and extended this gender difference to the finding that American and Hungarian men used more orientation strategies and females used more route strategies in way-finding. They also found that females in both countries reported a higher level of way-finding anxiety than did the men. Lawton and Kallai believed that the higher anxiety in women may stem more from safety concerns and less from the spatial aspect of the task. Most literature in way-finding deals with unfamiliar territory and women who live in high crime societies may be more anxious about venturing into alien environments (Lawton & Kallai). In their second experiment, men from both cultures reported significantly more way-finding experiences as children than women did, and women reported lower ratings of feelings of personal safety.

On male superiority in geography, Henrie, Aron, Nelson, and Poole (1997) suggested that there is a difference in childrens' educational experiences, in that males and females are not being equally socialized to broad geographic knowledge. However, the flaw in socialization theories is that hormonal influences cannot be discounted, as cognitive gender differences in young children have been found to be small, if even present (Kimura, 1992). The conclusion that sex related differences do not appear until puberty supports both the environmental theory and hormonal theory (Hargreaves & Colley, 1987). Pre-pubescent findings have been inconsistent (1987). Obtaining a gender difference seems to depend on the complexity of the task, rather than the ability of the participant. It can also be argued that children are not yet able to cognitively perform the same spatial task as their adult counterpart, and therefore the same spatial ability is not being tested.

Herrmann, Crawford, and Holdsworth (1992) proposed that gender differences in everyday tasks are not as reliant on skill as they are on motivation. Perceived gender roles may heavily affect how men and women perform on tasks. Gender typed experiences and expectancies influence performance on memory tasks. Herrmann et al. (1992) showed that men perform better on tasks that are stereotyped as being masculine and females are stereotyped on tasks considered to be feminine. Males recall feminine objects less well than masculine objects (Hite, Zinser, & Beale, 2003; McGivern et al., 1997). It may be that social influences push males to remember masculine objects better than feminine objects. Females recall feminine objects the most and male objects to a lesser extent, although the gender difference between masculine objects is minimal. This may be due to that it is more socially acceptable for females to remember masculine objects than males to remember feminine objects. Maccoby and Jacklin (1974) noted that it was more acceptable for females to participate in a male oriented task, but there was negative feedback from parents if a male child chose to participate in a female oriented task.

Spatial Memory Research

It has been suggested that women and men process memory differently for different types of tasks (Kimura, 1999). Women may encode both object identity and object location cognitively together, while men process the two separately in the brain. This idea is supported by the findings that men perform better on location tasks and women on object identity tasks. Stumpf (1998) suggested that women excel in tasks that rely on past knowledge and verbal fluency, while males surpass women on tasks that combine new, more abstract strategies (such as mental rotation).

Way-finding

Basic spatial skills are involved in way-finding and geographic knowledge (Daubes et al., 1998). Men are more accurate in way-finding, directional judgments, directional relationships, and pointing tasks (Lawton, 1994). Women tend to excel on tasks that ask for memory of landmarks, object identification, and object placement. Men and women report that they use different strategies when trying to find a destination (Lawton & Kallai, 2002). Men used more cardinal directions and made fewer errors on direction estimation tasks (Ward, Newcombe, & Overton, 1986). Men typically used more route strategies than women, and women used more orientation strategies than men did when way-finding. Women also reported having more spatial anxiety than men did on way-finding tasks.

Lawton (2001) extended her research by creating an internet survey that asked participants to provide samples of route directions to a specific location in their home area. Women reported more landmarks, such as buildings, and men reported more cardinal directions. However, there were regional differences, especially in men. Men were more likely to use cardinal directions if they were from the Midwest/West or if they lived in an area in which the roads were arranged in a grid-like fashion. Lawton and Kallai (2002) looked at cultural differences in way-finding by comparing American and Hungarian responses. Men in both countries reported using more orientation strategies and women more route strategies, corresponding with previous results. However, the trend only approached significance in Hungary. This discrepancy was explained by cultural differences in way-finding experience for girls and boys. In both countries, men reported more way-finding experiences as children and women reported lower ratings of personal safety.

In spatial mapping tasks, men and women also generally use different strategies. Men showed a greater tendency to use Euclidean methods, that is, cardinal directions and distance concepts, while women relied more on topographical techniques, that is, relative directions and landmarks (Choi & Silverman, 1996; Daubes et al., 1998). Choi and Silverman proposed that women do not lack the ability for Euclidean methods of problem solving, but rely more on their superior object location memory. Silverman et al. (2000), tested way-finding to further explore the dimorphism proposed in their hunter-gatherer theory, focusing on navigation strategies. They led participants individually through a wooded area and stopped at preset locations in which the participants had to place an arrow pointing in the direction that their walk began. On all measures of way-finding men outperformed women.

Harrell, Bowlby, and Hall-Hoffarth (2000) explored the effect of route complexity, age, familiarity, and gender on way-finding. The experimenters choose to relate the characteristics of the person asking for directions as well as the gender of the person giving directions. Men gave more detailed and complete maps using more cardinal directions and also had greater confidence in their direction giving. Men also gave more complete directions to older people and for the more complex route. Familiarity did not have a significant impact other than relating to greater confidence in direction giving.

Similarly, Henrie, Aron, Nelson, and Poole (1997) found that males significantly outperformed females on map skills and geography. They suggested that not all psychologically labeled spatial skills can be compared to all geographic knowledge since most literature focuses on labeling locations, which is not the only concept involved in geographic knowledge. The results from the knowledge of geography test revealed that older participants performed better, and that male participants performed significantly better. There was no evidence that the number of geography classes taken, hours watching geographically oriented television shows, or knowledge of current events of a geographical nature.

Object Recall

Research has established that women are stronger verbally than men (Maccoby & Jacklin, 1974). Females have consistently been found to possess greater object recall memory (Hite et al., 2003; Kimura, 1999). Some have suggested the female superiority may be due more to stronger verbal skills and less due to superior spatial skills. Silverman and Eals (1992, 1994) found that women were stronger in both object memory and object location memory for common and uncommon objects. By using uncommon objects Silverman and Eals eliminated any verbal advantage females may have had. McGivern et al., (1998) also attempted to eliminate verbal influence in object recall by using both common and abstract shapes. Females recalled significantly more nameable objects and abstract shapes than males. This supported the idea that the female advantage in object memory is not due to greater linguistic ability.

Daubes et al. (1998) demonstrated that women performed better on a Silverman and Eals type object memory task, although the effect only approached significance. Women also used more landmarks for navigational purposes. Daubes et al. proposed that superior feminine object location memory increases the use of landmark direction giving instead of the more abstract Euclidian navigation strategies.

Pezdek, Roman, Zbyszek, and Sobolik (1986) compared the recall of objects and words. Second graders, fifth graders, and high school students were tested on recall of objects and the spatial location of those objects. There were three conditions; one used 16 objects, the other the 16 objects plus a one word verbal label, and the third used only the verbal label. Recall of both objects and words increased with age. Objects alone and objects with words were recalled significantly more than the word presented alone in both the object memory and spatial location. It is interesting to note that in the spatial location measure, the word only scores were not significantly affected by age. These results supported the idea that memory for spatial location and object memory is encoded separately from memory for words. Another experiment by Pezdek et al. used college students to examine the difference between memory for objects versus a word label for the object. The participants were given one minute to view the objects or words, then had either a 30 or 90 second delay in recall. Objects were recalled more accurately than words. The 90 second delay lowered the object and verbal recall and location scores. Again, these results supported the idea that spatial memory for objects is encoded separately from spatial memory for words.

Methodological Variables

Research has established that gender differences prevail in spatial tasks (Maccoby & Jacklin, 1974). Investigators have targeted how gender differences may be reduced or eliminated (Hite et al., 2003; Zinser, Knox, Rhudy, & Marlow, 2002). Methodological differences may have contributed to the gender differences in spatial skills. Empirical findings suggest the type of task and how the task is presented contributes to finding gender differences. Another explanation for gender differences in object memory may be motivation. Males may be less motivated and females more motivated to encode and recall objects. Training of spatial tasks may decrease, if not eliminate, gender differences by increasing task knowledge and motivation.

Types of Spatial Tasks

There are different forms of “spatial tasks”. At first it was concluded that men were superior to women on spatial tasks. Kimura (1999) attempted to clarify the meaning of tasks that are labeled spatial. Spatial orientation has been found to have the most consistent and reliable results in favor of males. Spatial orientation requires the participant to correct for changes in the direction of an object without actually touching the object. This includes the well studied mental rotation tasks in which men excel. However, Stumpf (1998) noted that this category also included spatial location tasks with nearby locations, in which women have been found to surpass men.

Another spatial task involves spatial visualization in which participants must mentally imagine manipulating an object as to what happens when it is folded, cut, or put together with parts from another object (Kimura, 1999). Disembedding related to spatial visualization, but the participants find a simpler object hidden within a more complex object (Hargreaves & Colley, 1987). Field independence is the ability to determine vertical and horizontal in the real world. Males have been found to perform better on field independence tasks (Kimura, 1999). The water level task is one of the most widely used spatial perception task. Females have consistently had lower scores than males regardless of age and education level (Kimura, 1999).

Directed versus Incidental Recall

How a spatial task is presented to participants is as important as the actual task the participants are asked to perform. A directed task is when the participants are aware of what the task is and what they are being asked to do. An incidental task is when the participants are not informed about processes that will be tested. Females typically perform better than males on incidental recall tasks (Maccoby & Jacklin, 1974). For example, in the incidental task Silverman and Eals (1992) ushered the participants to a room and asked them to wait for two minutes while the experimenter set up for the experiment in a nearby room. After the two minutes had elapsed, the participants left the room and were asked to recall as many of the objects that had been placed on the desk in the waiting room as possible. Females performed better on the incidental task for both object memory and object location. Silverman and Eals repeated the same experiment but used a directed recall task. The participants were led to the room containing the objects and were told that they would have two minutes to try and memorize as many of the objects as possible. There was not a significant gender difference in the directed recall tasks, although females performed better. Eals and Silverman's (1994) experiment also replicated their 1992 experiment, that is they used uncommon objects. Again, females performed better but, interestingly, only in the incidental learning condition.

McGivern et al. (1998) used Silverman and Eals' incidental learning task. Participants were told to click on a star that moved around on a computer screen that had objects in the background. Each time they clicked on the star the screen went blank for a second and then the star moved location again but the background stayed the same. After several trials they were then presented with the original background but with several objects added. Then they were asked to click on the objects that were not originally in the background. Females performed significantly better than males. McGivern et al. (1998) suggested that their results supported the Meyers-Levy hypothesis that females process visual stimuli in a more comprehensive manner than males do. McGivern et al. (1998) also used a directed learning task and again found female superiority.

Akin to incidental and directed tasks is the difference between passive and active tasks. Vecchi and Girelli (1998) focused on an active versus passive visual spatial task. Males have traditionally shown superiority in active spatial tasks. The active task consisted of participants imagining either a two or a three dimensional matrix of cubes and following a pathway when given three or six statements of direction. The passive task was the same except the matrix of cubes was visible to the participants. They found a large gender difference in the active task and a marginal difference in the passive task. These results suggest that men generally do better than women on more active abstract visual spatial tasks (such as mental rotation). Active tasks require more active processing in the brain whereas passive tasks have less cognitive manipulation of the objects.

Timing of Tasks

Stumpf (1998) found that women viewed spatial tasks as more difficult than men did. Women on average took more time than men did on a variety of spatial tasks. When no time limit was enforced, gender difference scores dropped on many spatially oriented tasks. When pressed for time, men perform superior than women. Men also generally performed better than women did when directed to focus on speed and accuracy (Scali, Brownlow, & Hicks, 2000), although gender differences were most consistent on the mental rotation tasks. On the other hand, women tended to excel in perceptual speed on tasks that deal with matching or recalling specific objects (Kimura, 1992).

Attention and Motivation

There may not be a gender difference in the cognitive aspect of spatial tasks but on what males and females pay attention to in a task. In other words, it may not be the skill level of the participants, but their motivational level that accounts for the gender difference. Maccoby and Jacklin (1974) noted that females tend to score higher than males on achievement motivation, but males also score higher than females on competitiveness. Females seem to pay more attention to specific details and the nearer surroundings, while males focus on the specific task that they were asked to complete. Gender differences may be due to females paying more attention to selected aspects of the environment.

Females have been found to be more compliant than males in many testing situations (Maccoby & Jacklin, 1974). McGivern et al. (1988) hypothesized that females may be more engaged in recall tasks or spend more time trying to remember objects and object locations than males. In their study, the compliance factor was eliminated by using an incidental learning task in which stimuli are presented without the participant knowing that that they later will be tested on those stimuli. With regards to performance in geography and way-finding, females reported having greater spatial anxiety than men (Lawton, 1994). Females may be more anxious and less motivated to explore unfamiliar environments.

Expectations can be an influencing factor in performance. When told that the task is spatially oriented, women tend to perform less well than men perform. The gender gap tends to be smaller when the task is not labeled as spatial (Henrie et al., 1997). Colley, Ball, Kirby, Harvey, and Vingelen (2002) attempted to test motivational influences on recall of gender typed tasks. They used the gender typed lists of Hermann, Crawford, and Holdsworth (1992). One group was told that men do better on the task; the other was told that women typically performed better on the task, and the control group received no motivational influences. Women performed significantly better than men on the shopping list and comparable to men on hardware list. Colley et al. suggested that the hardware list was not masculine enough for labeling purposes. The results of Colley et al., revealed that men and women try harder if told the task favors the opposite sex. However Holt, Zinser, and Tennyson (2001) did not find that telling the participants that women did better on the task affected the gender difference. Zinser et al. (2002) questioned whether women might be more intrinsically motivated and men more extrinsically motivated on object recall tasks. Zinser et al. offered an incentive of 10 cents per word recalled to one group, versus a no incentive for the control group. Replicating previous findings, women outperformed males, and the modest incentive did not affect the gender difference. Hite et al. (2003) found that women still outperformed men on object recall when an element of competition was introduced, although competition increased the scores of women and men.

Gender Typed Stimuli

The perceived gender orientation of the stimuli had an impact on performance. Hermann et al. (1992) had participants learn a shopping list (a female oriented task) and directions to a specific place (a male oriented task). Females recalled more of the shopping list and males more of the directions, as gender stereotypes would suggest. They then sought to determine if the label of a task made a difference. They had the participants memorize a shopping list labeled grocery list (feminine) and a shopping list labeled hardware store list (masculine). For the directions, they had participants memorize a set of directions to make a shirt (feminine) or a set of directions to make a workbench (masculine). Again, the results were consistent with gender stereotypes. Males performed better on the masculine oriented tasks, and females on the feminine oriented tasks.

The type of objects used also had an impact on performance. McGivern et al. (1997) used objects that were of a female, male, or neutral sexual orientation. Women scored better than men on female and neutral objects. Men performed equally as women on male objects. This result indicated that men paid the most attention to male objects, which is what the identified the most with, and overlooked female and neutral objects. Because women performed as well as men on male objects and better on female and neutral objects, is appears that women possess a greater awareness of their immediate environment than males.

Levy (1995) used pairs and single gender typed items on children's recall ability. Boys recalled significantly more male sexed items and girls recalled significantly more female sexed items. Levy suggested that even young children use gender roles as social categories to process information. Holt, Zinser and Tennyson (2001) revealed that regardless of gender role and gender type of stimulus, females recalled more items and location overall than males did. Similar experiments were repeated using the same gender typed items and also found female superiority in object recall (Hite et al., 2003; Zinser et al., 2001). By using gender neutral objects only, men and women may display equal interest and attention to the objects; these stimuli may eliminate gender role expectancies.

Training

When given training in spatial abilities, both male and female scores improve (Casey, 1996). Stumpf (1998) confirmed earlier findings on spatial tasks with male superiority in mental rotation and female superiority in visual memory tests. His results were considerably smaller, however, than expected. Stumpf attributed this to his methodology in which participants had detailed tutorials on how to complete the spatial tasks. This "mental practice" can be viewed as a form of training, which appeared to have affected the results by increasing scores overall.

Kass, Ahlers, and Dugger (1998) used two different training methods on the angle on the bow (a mental rotation) real world task. Participants either received no training (control), practice with feedback, or only received an instruction manual. Results were consistent with past literature with men giving fewer incorrect answers than women gave. The instruction manual did not affect the gender difference favoring males. However, the performance with feedback group yielded almost no gender difference; a half hour of practice with feedback eliminated all gender differences in performance. Kass et al. speculated that the instruction manual training was not as effective due to differing performance strategies in women, or due to the focus having been on the training of the task instead of the actual task. They also considered that the less abstract the task appeared to be, the more easily it was learned.

In relation to map learning, Beatty and Bruellman (1987) pursued findings from Beatty and Troster (1987) using four successive trials. Beatty and Troster found male superiority in an assortment of geographical knowledge tasks but no gender difference on location of places on an unfamiliar map when tested immediately after each trial. Beatty and Bruellman suggested that the gender differences in geography were not due to the capacity to remember locations, but that males may retain the information longer than females. They used the same method as Beatty and Troster but did not test the participants until after a 45-minute delay and then after a 48-hour delay. Gender differences were again found in favor of males on the location of real places, but there were no significant gender difference on the memory for locations of places on the unfamiliar map. This suggested than men and women have the same capability for learning and memory on map locations, but that men may pay more attention to maps than women do, and that more exposure or training on these tasks may eliminate gender differences.

Statement of the Problem

It has been well established that there are gender differences in spatial memory tasks. The current study attempted to track these gender differences over three memorization trials using gender neutral stimuli. Past studies have focused on female shortcomings on spatial tasks such as mental rotation and navigation (Kass et al., 1998). The current study focused on male deficiencies in the area of object recall. Holt et al. (2001) noted that the smallest difference between male and female object recall was with neutral objects. The decision to use only gender neutral objects was to give men and women the opportunity to address the objects with equal interest and attention. The current study also used pictures of the objects instead of the actual objects, as done by Holt et al. and Hite et al. to process more participants in a shorter amount of time. Pictures of objects have been used in Silverman and Eals (1992) and McGivern et al., (1998); with these women also performed significantly better than men did on object recall.

The question of interest is whether the gender difference in object memory will increase, decrease, or remain the same over trials. Results from a pilot experiment showed that females performed better than males and the difference increased over trials. However, the sample size (N = 25, 6 males, 19 females) was relatively small.

What aspects of object recall show men as inferior or women superior in performance? As Pezdek et al (1986) did, object memory and object location memory were scored separately; however, the current study focused on gender differences and not age differences. Object and object location scores tested recall memory, whereas the spatial location recognition measure, in which the participants were given the name of each object and asked to write which spatial quadrant the object was in, tested recognition memory.

Training has shown to be a relatively effective tool for increasing spatial performance. The majority of studies focused on improving overall scores or improving female performance on typically male oriented tasks (Kass et al., 1998). Gaulin and Hoffman (1988) noted that most training studies lacked the methodology to validate training versus non-training group comparisons on performance on spatial tasks. The current study will use three trials as a training activity for object recall, a typically female oriented task. The first trial will be a no practice condition, the second trial a practice condition, and the third trial the second practice condition.

Many everyday tasks are related to spatial memory, such a driving to school or finding the car keys. If these differences can be eliminated, then the object memory advantage for women would be called into question. Even though the gender differences were not eliminated in the current study, the value of this study was that it will provided more information on cognitive gender differences. If females perform significantly better across all trials than males, and the gender difference widens over trials, then this study will lend support to the theory that women possess greater spatial object recall and location memory than men do. This study could not determine whether the gender difference is due to hereditary, evolutionary, or environmental reasons, but it could add support to the idea than men and women process and encode object and spatial memory differently, with women being more effective than men on an object recall task. By replicating previous studies and questioning their methodologies and results, there can be a better understanding of the why and how of spatial cognition.

Variables

The independent variables were the gender of the participant and the number of spatial learning trials. The participants attempted to memorize as many of 60 objects and object locations as possible over three learning trials. The dependent variables were the number of objects recalled, the number of objects and locations (correct quadrant) recalled on each trial, the number of object locations recognized when given all 60 of the object names, and the six rating scales. The rating scale questions ranged from one to seven (with one being low and seven being high) and asked: How would you rate your memory skills?, How enjoyable was this task?, How difficult was this task?, How hard did you try on this task?, How competitive are you?, and Compared to others how would you rate your recall performance?. The purpose of these items was to assist with the interpretation of the data

Hypotheses

It was expected that women would perform significantly better than men across all three dependent variables, suggested by the results reported by Silverman and Eals (1992), McGivern et al., (1998) and Kimura (1992). It was hypothesized that men and women would significantly improve from trial one to trial three. Practice or training increases performance (Kass et al., 1998). If women are more effective than men on object recall tasks, then the gender difference gap should widen over the three series of trials. Results from the pilot study supported these hypotheses.

Gender It was hypothesized that women would recall significantly more objects, objects and locations, and correct location recognition responses than men would recall.

Training It was also hypothesized that participants would improve significantly from trial 1 to trial 3 on object and object and location recall. It was hypothesized that the gender difference would increase over trials. On trial 1 and trial 3 it was hypothesized that women would recall significantly more objects and objects and locations than men would.

Rating Scales It was hypothesized that men would rate their memory skills, competitiveness, and their recall performance as compared to others as being significantly higher than women. It was also hypothesized that women would rate the task as being significantly more enjoyable and difficult and that they tried harder than men.

CHAPTER 2

METHOD

Participants

Participants were undergraduate students from the College of Arts and Sciences (N = 103) of a mid-sized southeastern university. The group was composed of 50 males and 53 females. The IRB declared this experiment as exempt from the use of a consent form. The demographic questionnaire was used to document the participants' gender, age, student classification, race, and religious affiliation.

The mean age of the participants was 22.57 years (*SD* = 5.25), with an age range of 18 - 41 years. The majority of participants were Caucasian (88.3%) with 3.9% African American, 1% Hispanic, 1.9% Native American, 2.9% Asian/Pacific Islander, and 1.9% labeled their race as Other. The class status of the participants was 30.1% freshman, 22.3% sophomores, 15.5% juniors, and 32% seniors. Thirty-seven percent of the participants labeled their religious affiliation as Baptist, 19.4% Non-denominational, 8.7% Christian, 6.8% Catholic, 5.8% Methodist, 3.9% Church of Christ, and 17.5% labeled their religious affiliation as being Other.

Some instructors offered extra credit toward participant's course grade for participation. Those who chose not to participate were given the option of an alternative assignment given by the instructor for the same amount of credit. No participants chose the alternate assignment. Six classes were used. Two were in the spring semester (both Introduction to Psychology classes N = 5, N = 9), the other four were in the first summer session (Introduction to Psychology N = 18, N = 38, Introduction to Sociology N = 22, and Introduction to Personality, N = 11).

Design and Statistical Procedures

A 2 (Gender) x 2 (Trial 1 & 3) mixed design with a repeated measures on the first and third trials variable was formed. The dependent variables were the number of object recalled correctly and number of objects and locations (quadrant) recalled correctly. Separate independent samples *t* tests were calculated between men and women on the above dependent variables and also on the number of objects labeled in the correct locations when given all of the object names (object location recognition measure). Separate dependent samples *t* tests were calculated on trials on the number of object recalled correctly and number of objects and locations (quadrant) recalled correctly. The alpha level was set at less than or equal to .05. Because the data were ratio, Pearson *r* correlations were performed on the scores of the above dependent variables, with both gender groups combined. Because the rating item data were ordinal, Spearman rho correlations were performed between all pairings of the rating scale items. For the same reason, Mann-Whitney *U* tests were performed between women and men on the responses for the rating scales: “How would you rate your memory skills?” (memory1), and on each of the six rating items: “How would you rate your memory skills?” (memory2), “How enjoyable was this task?” (enjoyable), “How difficult was this task?” (difficult), “How hard did you try on this task?” (hard), “How competitive are you?” (competitive), and “Compared to others how would you rate your performance?” (compared).

Apparatus / Materials

A stop watch was used to time the trials. The test packet included: a cover sheet and a sheet containing general instructions (see Appendix A), introduction to procedures (see Appendix B), instruction checklist (see Appendix C), three trial object and quadrant recall instructions and three test sheets (see Appendix D), one location recognition test sheet (see Appendix E), six rating items (see Appendix F), demographic questionnaire (see Appendix G), and checkout instructions (see Appendix H). Pictures of the 60 gender neutral objects were presented in color on two 8.5 x 14 inch sheets, taped together lengthwise. Quadrants A and B were on top and quadrants C and D on the bottom. Fifteen objects were presented in each section (see Appendix I). This paper was folded in half vertically so that the participants could not view the objects before they are directed to do so. The objects could not be seen through the sheets because an extra piece of paper was taped to the back of the object sheets. This object sheet was handed-out separate from the test packet.

Selection of Gender Neutral Objects

This section will explain how the 60 gender neutral objects were selected prior to the thesis proposal. This was done because no previous list of gender neutral objects was available. Advanced general psychology laboratory students were asked to list 30 typically male, 30 typically female, and 30 typically gender neutral objects. Fifty-two chose to participate. Altogether, they listed about 4,000 objects. Words that did not meet the criteria, such as being able to fit on a desk and difficult to photograph, were then discarded. Words listed in the gender neutral category that also frequently occurred in the male and / or female category were discarded from the gender neutral list, leaving 766 entries in the neutral category. After duplicates were removed 216 gender neutral objects remained. The 100 most frequently occurring gender neutral words were then identified.

After the top 100 words were identified, a group of five psychology graduate students was convened to select the 60 objects from the list of 100 objects that they thought were the most typically gender neutral and were most appropriate for the current experiment. This was done by the group picking the top 60 words they thought was most appropriate. Then the lists were compared and were discussed until a consensus was reached on the best 60 objects to use. Photographs of the 60 objects were then gathered by the experimenter from the internet and presented to the same evaluation group and verified as to their gender neutral label.

Next, these 60 gender neutral objects, along with 10 pre-labeled “typically male” and 10 “typically female” objects, were then presented in a random order to another small advanced general psychology class (N=27). They labeled the 80 objects as to which category they thought was most appropriate. The majority of the class (90%) classified all of the objects into their original gendered category. It was decided that the 60 gender neutral objects were appropriate for the current experiment.

Selection of Spatial Placement of Objects

All 60 objects were alphabetized and then the letter A, B, C, & D was assigned to each object sequentially. This resulted in 15 objects in each quadrant (A, B, C, & D) (see Table 1). The objects were placed randomly by the experimenter in each of their assigned quadrant.

Pilot Study

A pilot study was performed on a small advanced general psychology class (N=25) using the test packet and pictured objects. There were six males and 19 females. The purpose of the pilot study was to provide information on the quality of the test packet. The class listed any difficulties they had in understanding or completing the study. They were asked to list any objects they thought were not gender neutral. Results indicated that the participants concurred that all of the objects presented were gender-neutral. All the participants verified that they understood the instructions and had no major difficulties with participating in the experiment. A 2 x2 (gender x Trial 1 vs Trial 3) MANOVA was performed on the results which showed that there were significant gender differences in favor of women on trial 1 and trial 3 on object recall and location. The maximum number of objects recalled on Trial three was 34. See Table 2 for dependent variable means and standard deviations.

Table 1

Pilot Study Means and Standard Deviations of Dependent Variables for Gender

	Means (Standard Deviations)	
	Men	*Women*
Trial 1 Object	7.67 (2.07)	10.26 (2.31)
Trial 3 Object	14.0 (6.0)	21.58 (5.41)
Trial 1 Object and Location	7.33 (1.75)	9.26 (1.58)
Trial 3 Object and Location	13.17 (6.31)	20.53 (6.21)
Spatial Recognition	31.33 (11.17)	39.21 (8.73)

Procedure

The participants were tested in their classrooms and were told that they would be asked to memorize 60 objects with 15 objects in each quadrant (A, B, C, & D). The participants were told they would have one minute to memorize as many objects and locations as possible and that they would do this for three consecutive trials. After each trial they would be asked to recall the objects and their locations. The time between trials would be less than one minute long. After the tree trials, participants would then be given all 60 of the object words and then asked to write which quadrant each object was located in. They would also be asked to respond to several questions about the experiment and about themselves. The participants were reminded again that they must be at least 18 years old to participate and that participation is voluntary. They were also told that their responses will be kept confidential.

The test packets were distributed face down (see Appendices A-H). The participants were asked not turn the packet over or open the packet until told to do so. After all of the packets were distributed, the participants were asked to turn over the test packets and to read the instructions. The instructions were also read aloud by the experimenter, as the participants read them. On the next page, they were asked to briefly iterate what the experiment was about. The test packets for participants who did not answer this question correctly were not used in the final data analysis. No test packets were excluded. After the instructions were read, the folded object recall sheets were passed out. The participants were then asked to open the sheet with the pictures of the objects and given one minute to view the 60 objects. The experimenter timed the object memorization with a stopwatch. After one minute expired they were asked to refold this sheet. Then they were asked to try to recall as many of the 60 objects as possible by writing them in the appropriate quadrant on the recall sheet in three minutes (trial one). After three minutes had expired, the participants were asked to turn the page to the trial 2 instruction sheet. They were then asked to view the same 60 objects again for one minute. After refolding the sheet with the objects on it, they were again given three minutes to try and recall as many of the 60 objects as possible by writing them in the appropriate quadrant (trial two). They followed the same procedure for trial three. Following the third trial the object sheet was collected from all of the participants.

After collecting the object sheets, the participants were asked to place all 60 objects into quadrant A, B, C, or D. All names of the objects were provided and they were asked to write the correct quadrant letter next to each of the listed names (which had been placed in random order). They had three minutes to complete this task. Thereafter, they were asked to respond to several rating scales regarding themselves and the experiment and to fill out a demographic questionnaire. After completing the test packet, the participants raised their hand when done and the experimenter collected the completed test packet. The check-out instructions included telling the participants that they may obtain additional information regarding the experiment after all of the data have been collected by contacting the psychology department at 423-439-4424 and asking the participants not to share information regarding the experiment with others. The participants were also thanked for their participation.

CHAPTER 3

RESULTS

Object Recall

A 2 (gender) x 2 (trials 1 & 3) mixed design with a repeated measures on the first and third trials variable revealed a significant main effect for gender, F(1, 101) = 11.62, $p < .01$, $n^2 = .103$. Women (*M* = 18.27, *SD* = 5.62) scored significantly higher than men (*M* = 15.32, *SD* = 4.31) scored on the correct number of object names recalled. There also was a significant main effect for trials, F(1, 101) = 567.47, $p < .01$, $n^2 = .849$. Significantly more object names were recalled on trial 3 (*M* = 23.25, *SD* = 6.92) than on trial 1 (*M* = 10.43, *SD* = 3.22).

There was also a significant gender x trials interaction effect, F(1, 101) = 5.93, $p < .05$, $n^2 = .055$ (see Figure 1). A dependent samples *t* test was conducted between trials. Men recalled significantly more correct object names on trial 3 (*M* = 21.06, *SD* = 6.13) than they recalled on trial 1 (*M* = 9.58, *SD* = 3.0), *t*(49) = 12.58, $p <.001$. Women recalled significantly more correct object names on trial 3 (*M* = 25.32 *SD* = 7.03) than they recalled on trial 1 (*M* = 11.23, *SD* = 3.24), *t*(52) = 13.75, $p <.001$. An independent samples *t* test was conducted between men and women. On trial 1, women recalled significantly more correct number of object names (*M* = 11.23, *SD* = 3.24) than men recalled on trial 1 (*M* = 9.58, *SD* = 3.0), *t*(101) = 2.67, $p <.01$. On trial 3 women also recalled significantly more correct number of object names (*M* = 25.32, *SD* = 7.03) than men recalled on trial 3 (*M* = 21.06, *SD* = 6.13), *t*(101) = 3.27, $p < .01$. See Table 2 for means and standard deviations of gender x trials for objects recalled.

Table 2
Means and Standard Deviations of Gender x Trials for Objects Recalled

	Means (Standard Deviations)		
	Men	*Women*	Total
Trial 1 Object Recall	9.58 (3.0)	11.23 (3.24)	10.43 (3.22)
Trial 2 Object Recall	15.74 (3.98)	18.92 (5.32)	17.38 (4.96)
Trial 3 Object Recall	21.06 (6.13)	25.32 (7.03)	23.25 (6.92)
Total	15.32 (4.31)	18.27 (5.62)	

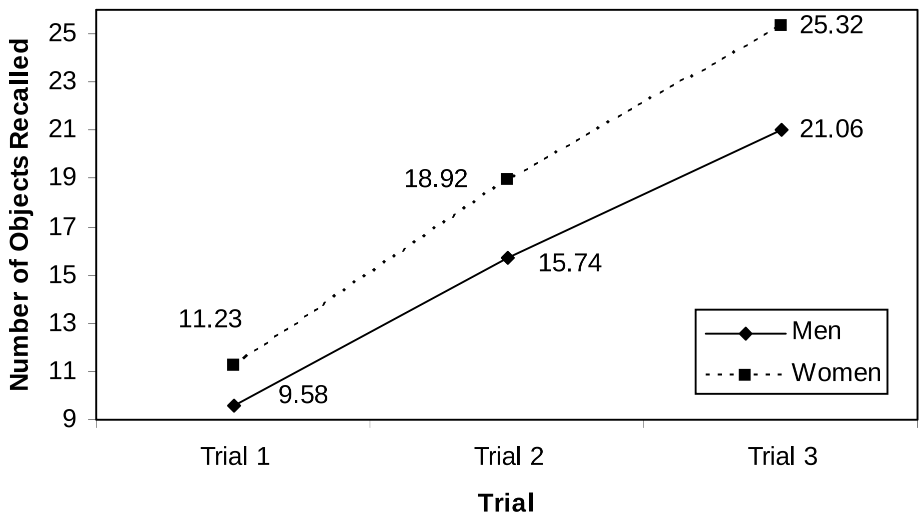

Figure 1. Mean Number of Objects Recalled for Gender x Trials

Object Recall and Location

A 2 (gender) x 2 (trials 1 & 3) mixed design with a repeated measures on the first and third trials variable revealed a significant main effect for gender, F(1, 101) = 9.19, $p < .01$, $n^2 = .083$. Women ($M = 16.8$, $SD = 4.21$) scored significantly higher than men ($M = 14.03$, $SD = 3.78$) on the correct number of object names and locations recalled. There was also a significant main effect for trials, F(1, 101) = 460.08, $p < .001$, $n^2 = .820$. Significantly more object names and locations were recalled on trial 3 (*M* = 21.83, *SD* = 7.5) than were recalled on trial 1 (*M* = 9.09, *SD* = 3.06).

There was also a significant gender x trials interaction effect, F(1, 101) = 759, $p < .01$, $n^2 = .07$ (see Figure 2). A dependent samples *t* test was conducted on the dependent variables between trials. Men recalled significantly more correct objects and object locations on trial 3 (*M* = 19.56, *SD* = 6.70) than they recalled on trial 1 (*M* = 8.5, *SD* = 2.88), $t(49) = 11.01$, $p <.001$. Women recalled significantly more correct objects and object locations on trial 3 (*M* = 23.96, *SD* = 7.65) than they recalled on trial 1 (*M* = 9.64, *SD* = 3.14), $t(52) = 13.05$, $p <.001$. An independent samples *t* test was conducted on the dependent variable between men and women. On trial 3, women recalled significantly more correct number of object names and locations (*M* = 23.96, *SD* = 7.65) than men recalled on trial 3 (*M* = 19.56, *SD* = 6.70), $t(101) = 1.92$, $p <.001$. Trial 1 was approaching significance with females recalling more correct number of object names and locations (*M* = 9.64, *SD* = 3.14) than males recalled on trial 1 (*M* = 8.5, *SD* = 2.88), $t(101) = 3.1$, $p = .058$. See Table 3 for means and standard deviations of gender x trials for objects and locations recalled.

Table 3
Means and Standard Deviations of Gender x Trials for Objects and Locations Recalled

	Means (Standard Deviations)		
	Men	Women	Total
Trial 1 Object Location Recall	8.5 (2.88)	9.64 (3.14)	9.09 (3.06)
Trial 2 Object Location Recall	14.4 (4.28)	17.45 (5.3)	15.97 (5.05)
Trial 3 Object Location Recall	19.56 (6.7)	23.96 (7.65)	21.83 (7.5)
Total	14.03 (3.78)	16.8 (4.21)	

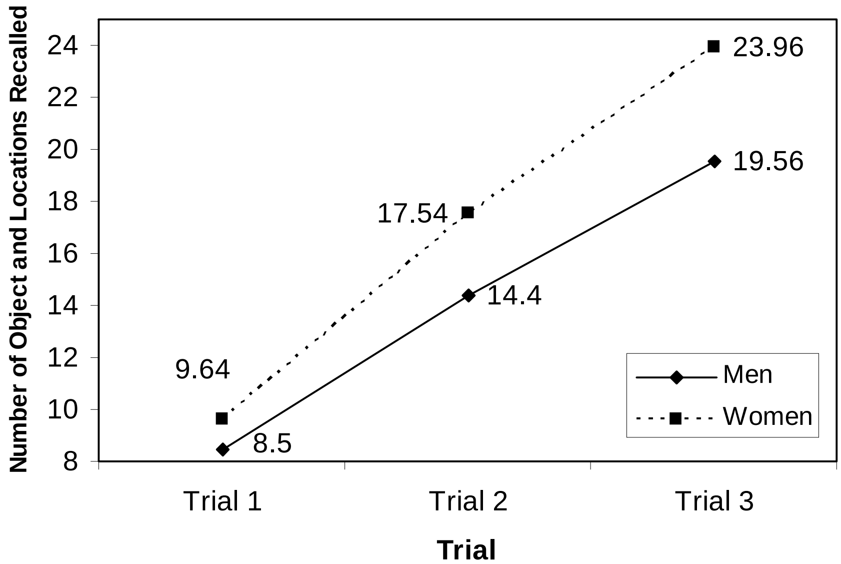

Figure 2. Mean Number of Objects and Locations Recalled for Gender x Trials

Object Location Recognition

An independent samples *t* test revealed that women (M = 41.74, SD = 9.34) gave significantly more correct answers than men (M = 35.18, SD = 12.19) when presented with all of the object names and asked to write the correct quadrant location (object location recognition task) $t(101) = -3.07$, $p < .01$.

Rating Items

Rating items being an ordinal measurement, a Mann-Whitney *U* test was conducted for each of the rating items (memory1, memory2, enjoyable, difficult, hard, competitive, and compared) across the gender variable (see Table 5 for description of rating items and mean ranks). The only significant difference obtained was on the competition measure, $z = -2.36$, $p < .05$, with men having a significantly higher mean rank (M = 58.95) than the women (M = 45.44).

However, with the exception of memory2, the men mean ranks were higher than the women's mean ranks. Table 4 provides the mean ranks for all of the rating variables.

Table 4
Mean Rank of Rating Variables for Males and Females

		Mean Rank		
		Men	*Women*	*z*
"How would you rate your memory skills"	(Memory1)	52.68	51.36	-.241
"How would you rate your memory skills"	(Memory2)	50.1	53.79	-.660
"How enjoyable was this task"	(Enjoyable)	53.68	50.42	-.568
"How difficult do you think this task was"	(Difficult)	55.35	48.84	-1.163
"How hard did you try on this task on this task"	(Hard)	55.49	48.17	-1.194
"How competitive are you"	(Competitive)	58.95 *	45.44*	-2.356
"Compared to others how would you rate your recall performance"	(Compared)	52.88	50.23	-.484

Note. p <.05*

Correlation Matrixes

The recall measures being ratio measurement, a Pearson Product Moment correlation matrix was generated for all possible pairings of trials 1, 2, 3, and the object, object and location, and the object location recognition measures. All pairings of the variables were positively and significantly correlated $p < .01$(see Table 5). The trial 2 object and the trial 2 object and location measures were very highly correlated ($r = .913$, $p <.01$). The trial 3 object and the trial 3 object and location measures were also highly correlated ($r = .885$, $p <.01$), as was the trial 1 object and the trial 1 object and location measure ($r = .866$, $p <.01$). In general, the object and object and locations measures were most highly correlated. Also in general, the correlations between the object and object and location across trials were lower. The highest correlation involving the object recognition measure was to the trial 3 object and location measure which was a moderate to high correlation (*r* = .726, *p* <.01). In general, the correlations involving the recognition variables were moderately high.

Table 5
Correlation Matrix of Trials, Object Recall, Location, and Recognition

	T1-Obj	T1-Obj&Loc	T2-Obj	T2-Obj&Loc	T3-Obj	T3-Obj&Loc	Recogni
T1-Obj	1.00	.866**	.710**	.618**	.609**	.514**	.587**
T1-Obj&Loc		1.00	.647**	.686**	.587**	.595**	.623**
T2-Obj			1.00	.913**	.858**	.773**	.640**
T2-Obj&Loc				1.00	.798**	.855**	.707**
T3-Obj					1.00	.885**	.679**
T3-Obj&Loc						1.00	.726**
Recogni							1.00

Note. p <.01**

Note. T1-Obj (Trial 1 object recall score), T1-Obj&Loc (Trial 1 object and location recall score), T2-Obj (Trial 2 object recall score), T2-Obj&Loc (Trial 2 object and location recall score), T3-Obj (Trial 3 object recall score), T3-Obj&Loc (Trial 3 object and location recall score), Recogni (Object location recognition score)

The rating variables being ordinal measurement, a Spearman rho correlation matrix was compiled using all of the ratings dependent variables (see Table 6). The memory1 and the memory2 correlations were moderately high (memory1 and memory2, *r* = .458, *p* <.01). The correlations between the memory skills ratings, how enjoyable the task was, and how participants compared themselves to the performance of others were moderate to low: (memory1 and enjoyable r = .25, p =.011; memory1 and compared r = .541, p <.01; memory2 and enjoyable r = .266, p = .007; memory2 and compared r = .595, p <.001). A moderate to low correlation was found between how hard the participants viewed the task and how enjoyable the task was, how difficult the task was, and how competitive the participants rated themselves, respectively, (r = .373, p <.001; r = .219, p =.027; r = .196, p =.048). How enjoyable the task was also correlated moderately low with how participants compared their performance to others (r = .256, p =.013).

Table 6
Correlation Matrix of Rating Items

	Memory1	Memory2	Enjoy	Difficult	Hard	Competitive	Compared
Memory1	1.00	.458**	.250*	.049	.021	.149	.541**
Memory2		1.00	.266*	.039	.132	.010	.595**
Enjoy			1.00	.141	.373**	.155	.246*
Difficult				1.00	.219*	.106	.090
Hard					1.00	.196*	.089
Competitive						1.00	.247*
Compared							1.00

Note. p <.05*, p <.01**

Note. See Table 5 for rating items

CHAPTER 4

DISCUSSION

Review of Results

The hypotheses for the gender and trials effects were confirmed. Women recalled significantly more objects, objects and locations, and spatial recognition of objects than men recalled with the exception of the trial 1 object and location scores. Moreover, trial 3 object and object and location scores were significantly higher than the trial 1 scores. The two additional spatial learning trials improved performance, as previous investigators similarly had reported (Casey, 1996; Kass et al., 1998). Women significantly outperformed men on both trial 1 and trial 3. Both men and women improved significantly from trial 1 to trial 3. Men had significantly higher scores on trial 3 than on trial 1, as did women. Although training increased performance for both men and women, the significant interaction indicated women improved more. This supports the idea that women are superior on object recall and location, and that training only increases the gender difference. Duff and Hampson (2001) suggested that women are more efficient than men are at remembering locations in an array due to a sex difference in working memory.

Women also outperformed men on the object location recognition task. When given the object name, women gave significantly more correct quadrant location responses than men did. This result also supported women superiority on object location recall. On the rating scale items the only significant difference was that men rated themselves as being more competitive than the women rated their competitiveness, supporting the hypothesis. Although competition was the only significant rating item, men rated themselves higher than women on the other rating scale items, with the exception of memory2.

Interpretation of Results

Women significantly outperformed men on object recall and object and location recall with the exception of the trial 1 object and location scores, which approached significance (*p* =.058). On this difference, perhaps male superiority in spatial skills somewhat offset the female advantage in verbal ability. Another explanation may be participants were not familiar with the format of the test packet. Although they knew that they would be asked to recall as many objects and their locations as possible, they may not have remebered that they would have to write the object in a specific location on the trial 1 recall sheet. This unfamiliarity may have affected the women participants more than the male participants. Lawton (1994) reported that females experienced more anxiety on a way-finding tasks (which deal with finding locations), and anxiety stemming from being in a new, unfamiliar location. The same may have happened on a smaller scale on the current experiment on the trial 1 object and location scores enough to offset the gender difference in object and location scores. Following trial 1, trial 3 object and location scores were significantly higher for females.

Both women and men recalled fewer objects and locations than just the recalling the objects themselves. Object location memory (where the pictures of the objects were located) may be encoded separately from memory for words of the objects, the labels written under the objects, (Pezdek et al., 1986). However, women may be better adapted to using both encoding processes for object and location recall than males, as indicated by the women improving more than men did with practice. If so, then having both the picture of the objects and the verbal label of the objects at the same time, women had a greater advantage than the men did.

The results of the present experiment are consistent with the biological theory and the hunter-gatherer theory. McBurney et al., (1997) proposed that men and women developed different spatial skills. Females performed better on a memory task, and males performed better on a mental rotation task. McBurney et al. suggested that through evolution, men and women developed different spatial skills that corresponded to their living environment. For men, the memory task used cognitive demands of hunting and for women the cognitive demands of foraging.

Duff and Hampson suggested that if a biological advantage for women exists on object recall and location ability, then women should outperform men on a recall task when they both receive the same training, which was found in the current experiment. The gender difference increased from the first to the third trial indicating that additional training was not effective in closing the gender gap. If the gender gap cannot be closed, then it may be that the gender difference is a biological difference than merely a methodological difference that accounts for female superiority on object recall and location. Biological differences may have evolved from hunter and gatherer ancestors (Silverman & Eals, 1992).

Silverman and Eals measured both object memory and object location separately and reported female superiority. The current experiment also reported female superiority, although object and object and location memory were measured in the same experiment. Especially in a directed learning task (as the current experiment was), men and women process what they see in their environment differently. Women may pay more attention to details in their immediate environment (McGivern et al., 1998). These findings may be a result of the gender division in labor proposed by the hunter-gatherer theory, an evolutionary theory of gender differences in spatial tasks (Eals & Silverman, 1994; Silverman & Eals, 1992). Because the difference between males and females increased significantly over three trials, the gender difference may not be due to learning but a hereditary difference in perceptual style (Silverman & Eals). Spatially arrayed common objects, along with a verbal label, appears to have given women an advantage over males. Kimura suggested that men process object identity and location separately in the brain, while women process them both cognitively together.

The learning theory of gender differences on object recall and location is not strongly supported by the results of this experiment; however, they do not rule-out that learning plays a role. Because the stimuli used were gender neutral, the potential effect of gender-related objects should have been diminished, if not eliminated. There was no significant gender difference on how motivated the participants were, how much they enjoyed the task, how hard they tried on the task, how difficult they viewed the task, and how they did compared to others performance. Because there were no gender differences on the above mentioned motivational and ability factors, it may be that the female advantage on the current task was not a product of these factors. However, there was a gender difference in competition, but it did not seem to relate to the results because men produced higher competition ratings while they did less well on the recall measures than the women did. Hite et al. (2003) also found that males rated themselves as more competitive, but females still outperformed males on an object recall task. Higher competitiveness did not relate to higher male performance on any of the trials.

In the present experiment, when asked to rate their memory for the second time after the experiment (memory2), the ratings of men declined more than the ratings of the women. The factors responsible for this result may have lowered other ratings. Participants, especially males, may have viewed not being able to recall all the objects as a failure, accounting for the lower memory ratings. It was also unexpected that females did not rate the task as being significantly harder than males. Stumpf (1998) found that females typically view spatial tasks as more difficult than males do. Perhaps the women viewed the current experiment more as a memory task than a spatial task. If they were certain about the task being a simple memory recall experiment, their confidence levels may have risen to that of men.

Limitations of the Current Study

As with most social science research, conclusions from the experiment are limited to the sample population of the participants. The majority of participants were enrolled in summer classes, which may have had some effect on the results. Having a high percentage of seniors (32%) and freshman (30.1%) might also have accounted for differences. Seniors, as well as the older participants, may have had more experience in memorization tasks or spatial skill tasks than freshman and other younger participants. However, this difference in classification was unlikely to affect the gender difference found in the current experiment. There were six more women seniors than there were men senior participants, and 53 women total, compared to 50 men. Because women typically perform better in object recall, this advantage may have been enhanced by their being older. In the future, this idea can be studied further by questioning participants on their past spatial and recall experiences. The biological theory could be seen as playing a larger role if past female object recall and location experiences are the same or even less than male experiences.

In the current experiment, the spatial recognition task was different from the earlier verbal recall memory of objects because it drew simply on verbal recognition, the recognition of the location of the presented names of the objects in place of recall of the names of the objects and locations. By presenting the words for the objects the type of memory used was likely different. Females have been found to possess a greater verbal ability (Maccoby & Jacklin, 1974; McCourt et al., 1997). Thus in the current experiment, women may have had an advantage on the spatial recognition task for this reason alone. Although Pezdek et al. (1986) did not examine gender differences, they reported that objects alone and objects with words were recalled significantly more than the word presented alone in both an object memory and spatial location task. Higher scores might have been achieved on the recognition task by men and women in the current study if the objects were presented with and without the words, and then asked to be spatially located. This would have controlled for the women's verbal ability advantage, and possibly increased the scores of men relative to women.

Additionally, the objects used in the present study may not have been altogether gender neutral. The present set of objects had not been used before in an experiment. Confirmation of the gender status of the objects used should have been confirmed with the participants. As noted by Holt et al. (2001), there may have been some properties of the stimuli that made them easier to remember, such as the color. Although in the present experiment an effort was made to choose objects that had the same color, some objects were brighter or more colorful that others. However, it is unlikely that the color of the objects would have had an appreciable effect on the gender difference found.

Object location was not tested separately from object recall in the present experiment. Previous researchers used a test in which participants crossed-out objects that had been added or moved to another location from the original array of objects (Eals & Silverman, 1994; McGivern et al., 1998; Silverman & Eals, 1992). They tested for object recall by having participants write down as many objects as they could remember seeing from an array of objects. The current experiment tested for object memory and location memory at the same time with the same task. Participants had to recall as many objects as they could by writing them down while also indicating the objects' quadrant location. Not only did they have to write down the object name, but they also had to write each object down in the correct quadrant. Participants might have been able to recall even more object names if they were not pressured into putting them into the correct quadrant position. Some participants may have remembered more object names than they wrote down; they may have failed to write them down because they could not remember their location. However, this measure was perhaps more typical of what is required in performing foraging tasks.

Suggestions for Future Research

It is intriguing that females have been able to overcome gender differences favoring males on a spatial task with training (Kass et al., 1998), but the reverse did not happen in the current experiment with males. It may be that the gender difference can be overcome on spatial tasks but not on spatial verbal tasks as found in the present study. Also it may be that the type of training affects performance. Personal training with feedback was found to be the most effective in closing the gender gap (Kass et al.). Casey pointed out that although spatial improvement occurs with more spatial experiences, in most cases the improvement occurs for both men and women without affecting the gender gap.

Perhaps feedback would be beneficial in narrowing or eliminating the gender gap as it was in the experiment by Kass et al. (1998). Kass et al. tested three training conditions with an angle on the bow task. Men have generally performed better than women on this type of task without any training. The performance with feedback group was the only group that did not produce a gender difference, while the other two (no training, and training by instruction manual only) still favored males. In the present experiment, possibly three trials were not enough to offset gender differences between males and females. Additional trials along with a delayed recall test might be implemented to further examine the effects of spatial learning trials.

Beatty and Bruellman (1987) used a delayed recall task on a geography task. The participants learned the locations of 15 towns on an unfamiliar map and then were given four study-recall trials. Thereafter, they were tested 45 minutes later (trial 1) and again after a 2 day delay (trial 2). They found no significant gender difference on the delayed recall on the maps that were unfamiliar to the participants. Perhaps the same effect would be found on object recall, if not with familiar objects, then with unfamiliar objects. However males still performed superior to females on familiar geographical locations. Familiar places were considered to be places that the participants had previous knowledge about, i.e. the location of US states. Unfamiliar places town names and locations that the experimenters created.

With regard to location recall, a future study could use the same 60 objects but have them moved to a different location for each trial. This would decrease the chance of participants remembering the object and location together, and increase the likelihood that they would remember the objects and their locations separately. Participants would have several trials to remember the names of the objects, which would not change, but each trial the object would be moved to a different location, forcing participant to focus on location separately for each trial. This study would focus on remembering and testing the locations of the objects on each trial separately.

Males have consistently rated themselves more competitive than females have rated themselves. Possibly this competition can increase recall ability in males. Hite et al. (2003) showed that competition significantly increased performance in both men and women but did not affect the gender gap favoring women. Another manipulation such as same sex and different sex groups might examine how effective competition is and under what circumstances competition enhances performance best in males. Leonard (2003) had college students recall objects after they were told they were competing for a prize against either only other men or men and women as a group. The prize was a $5.00 gift certificate for the winner of each group. Under these conditions, Leonard failed to find a gender difference within the same-sexed or the coed group. However, the experiment was conducted in two large classrooms, with the test booklet simply stating with whom the participants would be competing against. Smaller experimental groups, such as an all men, men and women, and all women dyads may increase competitiveness by putting participants into a more competitive atmosphere. Participants might also be questioned about the competitiveness levels and what increases their motivation.

Obtaining a pre and post measure for all rating items might be considered to determine if the experiment had an effect on the participants' perceptions of their abilities. Previous recall and spatial experiences of participants also should be examined further. Lawton and Kallai (2002) reported that males have typically more experience with spatial learning situations than females. The same may be true of females with object recall and location experiences. A measure of the participants' verbal ability might also be obtained to determine if it affects spatial skill performance. Perhaps the gender difference would close if males and females of the same verbal level were tested together.

The current experiment should be conducted again using different populations other than students in the college of arts and sciences to extend research to a larger, more diverse population. For example, children should be used. If girls perform better than boys do, and the gender gap does not decrease over trials with children, then the biological and hunter-gatherer theory are strengthened and the learning / environmental theory is weakened. This would mean that experience is not as influential as gender is on object and location recall. People from other cultures should also be used to see if the gender difference favoring females is limited to the United States.

The gender status of the objects used should be confirmed, and also the gender status of the object recall task should also be examined. Holt et al. (2001) and Hite et al. (2003) found that the gender orientation of the object had an effect on performance. Females recall feminine objects the best and males recall masculine objects more frequently as well. Uncommon objects or abstract shapes might be used to eliminate any gender advantage. Hermann et al. (1992) found that the gender orientation of a task has a significant effect on performance, with males performing better on masculine tasks, and females on feminine tasks. If the task is preconceived to be feminine or masculine, it could affect participants' scores. In future experiments participants might be asked to rate the task on femininity and masculinity. The current experiment could also be repeated by using real objects instead of pictures, which would be a more realistic situation than looking at two dimensional pictures, although both objects and pictures have yielded similar results.

Conclusions

The current study found that there is a gender difference on verbal spatial memory for object and locations tasks favoring women. These results are consistent with past research showing female superiority on object and location recall. The results from mental rotation and way-finding experiments favor men, while the results from the present study and those of previous studies on object and location memory favor women. Perhaps spatial skills superiority is found in men and women; men and women may share superiority on spatial skills. On some women are superior and on others men are superior.

The current experiment is consistent with both the biological and evolutionary theory as proposed by Silverman and Eals (1992). Females seem to possess greater skill in spatial object memory. They also have been consistently shown to outperform males in memory of object location. However, the current experiment could not rule out environmental influences; the nature versus nurture debate could not be resolved.

Gaulin and Hoffman (1988) pointed out that few studies have tested training versus non training performance. The current experiment confirmed that training is effective in improving object recall and location performance. Everyday tasks involve using spatial skills. Practicing these skills improves performance. Although the gender difference favoring women did not decrease with additional learning trials, training did significantly increase performance for both men and women, only somewhat more for women than men. Future studies should continue to examine how training might influence gender differences in object and location memory.

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Appendix A

Sixty Gender Neutral Objects and Quadrant Locations

Quadrant Location

A	B	C	D
band aide	belt	blanket	backpack
paper clips	paper towels	nail clippers	newspapers
bookstore bag	bottle of water	bowl	calculator
playing cards	q-tips	pen	pencils
candy bars	cds	candy bars	clock
rubber bands	ruler	radio	razors
computer	crayons	credit card	desk calendar
fork	soap	scissors	shampoo
eraser	flag	glasses	glue
spiral notebooks	stapler	sock	soda can
gum	hair brush	index cards	jeans
tennis shoes	textbook	telephone	television
keys	lamp	light bulb	lock
t-shirt	tylenol	tissues	towels
matches	money	videotapes	wallet

Appendix B

Cover Sheet and General Instructions

Instructions: Please **DO NOT** put your name or any identifying marks on this test packet. Your answers will remain confidential.

You must be at least18 years old to participate. If you are under 18 years old, please raise your hand and return your test packet to the experimenter.

You will be participating in an object recall experiment. It will take approximately 15-20 minutes to complete. Participation is voluntary. You will not be penalized if you decide not to participate. If you do not wish to participate, please raise your hand and return the test packet to the experimenter. Your professor will give you an assignment you can complete for credit in lieu of participating in this experiment.

Please remain quiet throughout the experiment.

Please listen and read all instructions.

All information will remain confidential.

If you are over 18 and choose to participate in this experiment, please turn the page.

DO NOT RETURN TO THIS PAGE ONCE COMPLETED

Appendix C

Introduction to Procedures

Thank you for participating in today's experiment. This is a memory task. You will be asked to view 60 objects located on a folded piece of paper that will be handed out to you separate from this packet. PLEASE DO NOT OPEN THE FOLDED SHEET UNTIL INSTRUCTED. When instructed, please unfold this paper and you will have one minute to memorize as many of the 60 objects shown as you can, as well as the quadrant (location) of the object (A, B, C, or D). There are 15 objects in each of four quadrants on the page. The quadrants are labeled "A" in the upper left side, "B" in the upper right side, "C" in the lower left side, and "D" in the lower right side. I will keep track of the time. Each object has its name written directly below it. Try to memorize the objects according to the name written below them. After one minute has expired, please ***refold the paper with the objects*** on it and turn to the next page of the packet with the heading Trial 1 Object Recall. You will then have three minutes to write down as many of the 60 objects in the correct location as you can.

We ask you to repeat this procedure for trial 2 and then for trial 3. ***So you will have three consecutive trials to try and recall as many of the 60 objects and quadrant locations as you can.*** Try to recall as many objects and their quadrant locations as you can for each trial.

After all three trials have been completed, you will be asked to perform a object location recognition task. You will have three minutes to complete this task. Thereafter, you will be asked to respond to several rating scales regarding the experiment and some questions about yourself. After the packet is completed, the experimenter will collect your completed test packet. Please remain quiet throughout the experiment.

Appendix D

Instruction Checklist

Please answer the following questions:

1) Have you already participated in this experiment? Yes _______ No _______

If yes then please inform experimenter by raising your hand.

2) Have you heard anything about this experiment prior to today? Yes ______ No ______

If yes then what have you heard? ____

____

3) Briefly, what is this experiment about, and what will you be asked to do? ________________

____

How many trials will there be? ________

How many objects will there be? _______

4) How would you rate your memory skills?

1	2	3	4	5	6	7
Very poor						Excellent

DO NOT RETURN TO THIS PAGE WHEN COMPLETED

Appendix E

<u>Three Object and Quadrant Recall Instructions and Tests Sheets</u>

<u>Trial 1 Instructions</u>

In a few moments an object memory sheet will be distributed. The experimenter will tell you when to unfold this sheet. You will have one minute to try to memorize as many of the 60 objects shown and their locations as you can. The experimenter will keep the time. Try to memorize the objects according to the word that is written underneath them. After one minute has expired, please **refold the page** with the objects on it and turn to the next page in this packet.

DO NOT TURN THE PAGE UNTIL YOU HAVE <u>REFOLDED</u> THE OBJECT SHEET

DO NOT RETURN TO THIS PAGE WHEN COMPLETED

Trial 1 Object Recall

You have three minutes to try to recall as many objects as possible in the correct quadrant:

A		B	
1) ________	9) ________	1) ________	9) ________
2) ________	10) ________	2) ________	10) ________
3) ________	11) ________	3) ________	11) ________
4) ________	12) ________	4) ________	12) ________
5) ________	13) ________	5) ________	13) ________
6)________	14) ________	6) ________	14) ________
7) ________	15) ________	7) ________	15) ________
8) ________		8) ________	

C		D	
1) ________	9) ________	1) ________	9) ________
2) ________	10) ________	2) ________	10) ________
3) ________	11) ________	3) ________	11) ________
4) ________	12) ________	4) ________	12) ________
5) ________	13) ________	5) ________	13) ________
6)________	14) ________	6) ________	14) ________
7) ________	15) ________	7) ________	15) ________
8) ________		8) ________	

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<u>Trial 2 Instructions</u>

The procedure used in trial 1 will be repeated for trial 2. The experimenter will tell you when to unfold the object memory sheet. You will have one minute to try to memorize as many of the 60 objects shown and their locations as you can. The experimenter will keep the time. Try to memorize the objects according to the word that is written underneath them. After one minute has expired, please **refold the page** with the objects on it and turn to the next page in this packet.

.

DO NOT TURN THE PAGE UNTIL YOU HAVE <u>REFOLDED</u> THE OBJECT SHEET

DO NOT RETURN TO THIS PAGE WHEN COMPLETED

Trial 2 Object Recall

You have three minutes to try to recall as many objects as possible in the correct quadrant:

A		B	
1) ________	9) ________	1) ________	9) ________
2) ________	10) ________	2) ________	10) ________
3) ________	11) ________	3) ________	11) ________
4) ________	12) ________	4) ________	12) ________
5) ________	13) ________	5) ________	13) ________
6)________	14) ________	6) ________	14) ________
7) ________	15) ________	7) ________	15) ________
8) ________		8) ________	

C		D	
1) ________	9) ________	1) ________	9) ________
2) ________	10) ________	2) ________	10) ________
3) ________	11) ________	3) ________	11) ________
4) ________	12) ________	4) ________	12) ________
5) ________	13) ________	5) ________	13) ________
6)________	14) ________	6) ________	14) ________
7) ________	15) ________	7) ________	15) ________
8) ________		8) ________	

DO NOT RETURN TO THIS PAGE WHEN COMPLETED

<u>Trial 3 Instructions</u>

The procedure used in trial 2 will be repeated for trial 3. The experimenter will tell you when to unfold the object memory sheet. You will have one minute to try to memorize as many of the 60 objects shown and their locations as you can. The experimenter will keep the time. Try to memorize the objects according to the word that is written underneath them. After one minute has expired, please **refold the page** with the objects on it and turn to the next page in this packet.

.

DO NOT TURN THE PAGE UNTIL YOU HAVE <u>REFOLDED</u> THE OBJECT SHEET

DO NOT RETURN TO THIS PAGE WHEN COMPLETED

Trial 3 Object Recall

You have three minutes to try to recall as many objects as possible in the correct quadrant:

A

1) ________	9) ________
2) ________	10) ________
3) ________	11) ________
4) ________	12) ________
5) ________	13) ________
6) ________	14) ________
7) ________	15) ________
8) ________	

B

1) ________	9) ________
2) ________	10) ________
3) ________	11) ________
4) ________	12) ________
5) ________	13) ________
6) ________	14) ________
7) ________	15) ________
8) ________	

C

1) ________	9) ________
2) ________	10) ________
3) ________	11) ________
4) ________	12) ________
5) ________	13) ________
6) ________	14) ________
7) ________	15) ________
8) ________	

D

1) ________	9) ________
2) ________	10) ________
3) ________	11) ________
4) ________	12) ________
5) ________	13) ________
6) ________	14) ________
7) ________	15) ________
8) ________	

DO NOT RETURN TO THIS PAGE WHEN COMPLETED

Question: Briefly explain how you tried to memorize the objects (e.g. did you picture them on the page; did you memorize as a list; did you repeat the words in your head)? ________

____

____

____

This completes the object memory task.

The experimenter will now collect the object memory sheets.

It is very important that you do not go back to previous pages or look at the page with the objects on them again.

You will now have three minutes to complete the spatial location recognition task.

When instructed please turn the page.

DO NOT RETURN TO THIS PAGE WHEN COMPLETED

Appendix F

Spatial Location Recognition Task Sheet

Here is a list of all 60 objects. Please place them in the correct quadrant. There were 15 in each section. "A" is the upper left side. "B" is the upper right side. "C" is the lower left side. "D" is the lower right side. Write the letter beside the word. You have three minutes to complete this task.

1) band aid________	16) q-tips___________	31) desk calendar_____	46) tennis shoes______
2) nail clippers_____	17) candy bars______	32) soap ____________	47) jeans____________
3) belt____________	18) radio__________	33) eraser____________	48) textbook_________
4) newspapers______	19) cds___________	34) sock_____________	49) keys____________
5) blanket_________	20) razors_________	35) flag______________	50) tissues__________
6) paper clips_______	21) cigarettes_______	36) soda can_________	51) lamp____________
7) back pack_______	22) rubber bands_____	37) glasses__________	52) towels___________
8) paper towels_____	23) clock___________	38) spiral notebooks___	53) light bulb________
9) bookstore bag____	24) ruler____________	39) glue____________	54) t-shirt___________
10) pen___________	25) computer_________	40) stapler__________	55) lock_____________
11)bottle of water____	26) scissors_________	41) gum____________	56) tylenol__________
12) pencil__________	27) crayons__________	42) telephone_______	57) matches_________
13) bowls__________	28) shampoo_________	43) hair brush_______	58) video tapes_______
14) playing cards____	29) credit card________	44) television_______	59) money__________
15) calculator_______	30) fork_____________	45) index cards______	60) wallet___________

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Appendix G

Rating Questions

Please provide a rating for each of the following questions (circle a number):

1) How would you rate your memory skills?

1	2	3	4	5	6	7
Very low						Very high

2) How enjoyable was this task?

1	2	3	4	5	6	7
Not enjoyable at all						Very enjoyable

3) How difficult do you think this memory task was?

1	2	3	4	5	6	7
Not difficult at all						Very difficult

4) How hard did you try on this memory task?

1	2	3	4	5	6	7
Not hard at all						Very hard

5) How competitive are you?

1	2	3	4	5	6	7
Not competitive at all						Very competitive

6) Compared to others how would you rate your recall performance?

1	2	3	4	5	6	7
Inferior						Superior

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Appendix H

Demographic Questionnaire

Please check the appropriate answer.

Gender: Male ___________ Female ___________

Age: ____________

Classification:

Freshman _____ Sophomore _____ Junior _____ Senior ______ Graduate _______

Race:

Caucasian _____ African American _____ Hispanic _____ Native American ______

Asian/Pacific Islander ______ Other (write in) _________________

Religious affiliation:

Baptist _____ Catholic _____ Methodist ______ Church of Christ ______

Non-denominational ______ Other (write in) _______________________

Did you have any difficulties with any aspect of this experiment? YES _______ NO _______

If yes then please explain briefly____

____

____

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Appendix I

Checkout Instructions

This completes the object recall experiment.

Your answers will remain confidential.

If you have any questions regarding this experiment or its results, please feel free to contact the psychology office in about four weeks at 423-439-4424.

Please keep all information regarding this experiment confidential. Additional persons will be participating in this experiment, it is important that they have not been informed of its contents or purpose.

Thank you for participating. Please raise your hand when you have finished this booklet and the experimenter will take your completed packet from you. Please wait quietly while others are finishing their booklet.

Appendix J

Objects and their Quadrant Locations

Objects located in section "A"

Band-aid

Paper clips

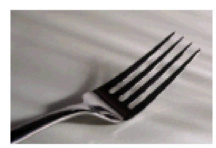
Bookstore Bag

Playing cards

Candy bars

Rubber bands

Computer



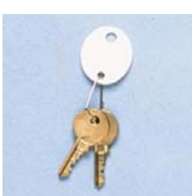
Fork

Eraser

Spiral notebooks

Gum

Tennis shoes



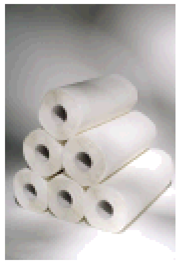
Keys

T-shirt

Matches

Objects located in section “B”

Belt

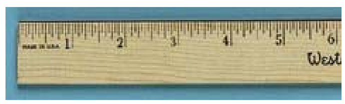


Paper towels

Bottle of water

Q-tips

CD’s



Ruler

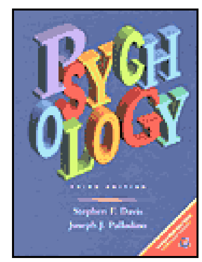
Crayons

Soap

Flag

Stapler

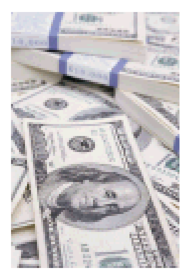
Hair brush



Text book

Lamp

Tylenol



Money

Objects located in section "C"

Blanket

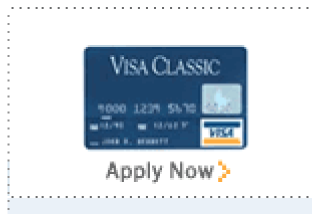

Nail clipper

Bowls


Pen

Cigarettes

Radio



Credit card


Scissors


Glasses


Sock

Index cards


Telephone

Light bulb

Tissues


Video tapes

Objects located in section “D”


Back pack

Newspapers


Calculator


Pencils


Clock

Razors

Day planner

Shampoo


Glue

Soda can


Jeans


Television


Lock


Towels


Wallet

VITA

TIFANI R. HITE

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Honors:	Psi Chi: President: 2002-2003, Secretary/ Treasurer: 2000-2002 Graduate Student Association of Psychology: Vice President: 2002-2003, Secretary: 2001–2002 Presidents Pride: University Advancement 2002 - 2003 Psychology Club: Secretary: 2000–2001, Treasurer: 2000–2001 Gamma Beta Phi: 2001–2003