Document Type: Original Article
doi: 10.22034/IEPA.2019.185013.1105

Iranian Journal of Learning and Memory, 2019, 2 (6), 31-50

Spatial Memory and Symptoms of Neuroticism: Gender Differences in a Spatial Task

Ali Hosseinpour Najjar⁎, M.A.
Department of Psychology, Islamic Azad University, Isfahan (Khorasgan) Branch, Isfahan, Iran
Elham Foroozandeh, Ph.D.
Department of Psychology, Islamic Azad University, Naein Branch, Naein, Iran
Amineh Sadat Tabatabaei, Ph.D.
Department of Psychology, Islamic Azad University, Isfahan (Khorasgan) Branch, Isfahan, Iran
Ehsan Soleimanpour, M.A.
Department of Islamic Architecture, Imam Reza International University, Mashhad, Iran

Abstract

This study was an attempt to investigate the relationship between spatial memory and Symptoms of Neuroticism in men and women visitors of a flower garden. The participants were chosen by an available sampling method among people who visited flower garden, located in Isfahan, Iran in October 2016. Subjects (woman=36, man=24) were asked to specify approximate locations of eight sites in the flower Garden on the incomplete map of flower garden after visiting the garden. Then, the subjects filled a demographic questionnaire and a short form of Eysenck introversion-extraversion questionnaire. The results showed that the means of spatial memory in men are significantly more than those of women ($F= 11.46$, $p<0.05$) and also, neuroticism in men is significantly less than that in women ($F=7.22$, $P<0.05$). Furthermore, positive relationship between age and spatial memory ($r= 0.41$, $p<0.01$) and negative relationship between neuroticism and spatial memory have been discovered ($r= -0.59$, $p<0.01$). According to the results, it can be concluded that neuroticism avoids paying attention to the environment and it causes memory function slump.

Keywords: Environmental psychology, gender differences, neuroticism, spatial memory

Introduction

Spatial learning and memory are affected by participants' activity or passivity in a natural or virtual environment (Sandamas & Foreman, 2014). Gender as a factor that influences human behaviors in a large extent (Sneider, et al., 2015), may change the male and female s concentration on environmental cues. There are a lot of gender differences between men and women in behavioral, physiological and pathological functions (Fausto-Sterling, 2012; Helpern, 2011; Jancke, 2018; Lippa, 2009; Wizemann & Pardue, 2001). Likely, one of the cognitive differences between men and women is their ability to solve spatial issues.

Considering different abilities of men and women to solve their spatial issues, there are two possibilities. First of all, men and women are different in sorting information they receive and secondly, their cognitive abilities to solve their spatial problems. With regard to the foregoing claim, Catherine, Jones and Healy (2006) showed that, neither men nor women had significant differences in their memory in the way they draw attention to visual characteristics of things and also in the sort of information they cognitively analyzed; nevertheless, women acted weaker rather than men in recalling the locations (the specific locations, location of the objects). This finding showed that there were specific cognitive differences between men and women based on the place. In different environments, women pay more attention to prominent details than men; whereas men pay more attention to more objective features like the geometric

⁎ **Corresponding Author**
Email: alihoseynpoorphd@yahoo.com

Received: 04/09/2019
Accepted: 07/15/2019

shapes of an environment, the area of an environment, directions, addresses and paths (Catherine, Jones & Healy, 2006). It's assumed that spatial ability is not a general concept. Researchers have used various tasks to measure spatial ability and some gender differences have been found in doing spatial tasks between men and women. For instance, mapping ability (Spencer & Weetman, 1981; Wang, Chen, Zheng, & Liao, 2019), explaining verbal addresses (Dabbs, Chang, Strong & Milun, 1998; Sneider et al, 2015), eye tracking abilities and ability of doing computerized virtual labyrinth (Anderson, Dahmani, Konishi, & Bohbot, 2011; Sandstorm, Kaufman & Huettel, 1998) and also map using abilities like proper map reading (Gron, et al., 2000; Saucier et al., 2002) are some reports of spatial differences between men and women. Several theories have been proposed to explain gender differences in spatial ability. The most important one is Personal Zone Theory (PZT). According to this theory, men occupy more personal space than women (Ecuyer-Dad & Robert, 2004; Hecht, Welsch, Viehoff, & Lango, 2019).

The other theories which explain gender differences in human spatial ability include Men and Women's Searching Theory (Elas & Silverman, 1994), Men's Warfare Theory (MWT) (Geary, 1995) and Women's Fertility Theory (Sherry & Hampson, 1997). One of the most important explanations for sexual differences in spatial ability has been expanded by women fertility theory. According to this theory, natural selection acts against women in a way that it causes them to acquire less spatial ability during their development stages and it can be a positive point for them because it helps them to stay near their vulnerable children and not to go far away. Ability to recall the locations can depend on the environment where memorizing has been done there. Montello, Lovelace, Colledge and Self (1999) showed women did tasks based on recalling the locations better than men in a smaller environment like a house. For instance, they recalled the place of things in their house better than men in the same house.

Several types of researches have been done to determine the relationship between age and ability to perform tasks based on spatial ability in men and women and their findings can be divided into three groups. The first group of findings showed that, with age increase, men's ability to perform spatial tasks decreased more than women (Barret- cannor & Kritz – Silverstein 1999; Meyer et al., 1999; Rowe, Turcotte, & Hasher, 2004). Second group of findings supported that with age rise, women's spatial ability fell more than men (Meinz & Salthouse, 1998; Prince, Lewis, Bird, Blizard, & Mann, 1996), and third group of findings couldn't find any significant differences between men and women regarding the amount of change in abilities to perform spatial tasks with age rise (Barnes et al., 2003; Maitland, Intrieri, Sehaie, & Willis, 2000; Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003). This gap between the results of these three groups of researches may occur due to different kind of sample tasks that have been used to conduct each research. It seems spatial ability is different between men and women in different tasks.

Neuroticism is a fundamental personality trait in the study of psychology characterized by level of one's anxiety, fear, moodiness, envious, frustration, jealousness, and loneliness (Thompson, 2008). Individuals who score high in symptoms of neuroticism are more likely than the average to experience such feelings as anxiety, anger, envious, guilt, and depressed mood (Matthews & Deary, 1998). They respond more poorly to stressors, are more likely to interpret ordinary situations as threatening, and minor frustrations as hopelessly difficult and they are often self-conscious and shy, and they may have trouble controlling urges and delaying gratification (Ormel et al., 2013).

Indeed it may be true to say that neuroticism disturbs cognitive abilities. There are some evidences to support this contention. For instance, Cognitive ability can act as a buffer against neuroticism (Perkins & Corr, 2005). Needless to say, spatial ability is one of the cognitive abilities. Studer-Luethi, Bauer, and Perrig (2012) tried to discover the relationship between amounts of neuroticism, and working memory as well as cognitive performance in school-age children) (7 to 12 years). The results of this research indicated that high neuroticism scores predicted poorer performance in working memory and cognitive performance. Personality Stability and less neuroticism also were associated with better cognitive performance in adulthood (Graham & Lachman, 2012). Although exploring a link between gender and neuroticism is a controversial issue, some studies showed that women's neuroticism scores were higher than men measured by Big Five and NEO-PI-R (Costa, Terracciano, & McCrae, 2001; Weisberg, DeYoung, & Hirsh, 2011). Additionally, women scored higher than men in related indices not specifically designed in the Big Five, such as anxiety (Feingold, 1994; Kinrys & Wygant, 2005).

In this paper, we tried to clarify the relationship between spatial memory and symptoms of neuroticism in men and women visitors of a flower garden.

Method

Participants

The population of this research was chosen by an available sampling method among people who have visited Flower Garden, located in Isfahan, Iran in October 2016. Participants included 60 men and women between 17-37 years old. Original sample size was larger but participants who did not complete the questionnaires and were less than 17 and more than 40 years old were excluded of this research.

Instruments

Some tools were used in this research as follows:
1- Demographic Questionnaire: The participants were asked about some demographic information such as their age, gender, educational status, marital status, family position and occupation.
2- Spatial Memory Task: When the participants had already finished their visit from Flower Garden, an incomplete map of the garden was given to them (Figure 1). Afterward, the pictures of eight sites in the Flower Garden were shown to the participants. The pictures included the rural cottage, cactus garden, lake, cafe, medicinal plants collections, Japanese garden, canopies and toilet (Figure 2). Thereafter, they were asked to draw approximate locations of these eight sites on the incomplete map. Needless to say, subjects didn't have any information about this research when they entered to the Flower Garden. In the beginning of their visit, they were not aware that they are going to do a cognitive task in the end. Scoring of this task consists of three options. First, if approximate location of each site drawn by subjects on the incomplete map was adapted correct place on the complete map more than 50% (more than 25 mm conformity) (Figure 3), it gained 1 point. Second, if approximate location of each site drawn by subjects on the incomplete map was adapted correct place on complete map less than 50% (less than 25 mm conformity), it gained 0.5 points and third, if it was completely far from the correct place (0 mm conformity), it took 0 points. The maximum score of this task that one could take was 8 and the minimum was 0. Moon, Jo, Kim, and Ryu (2016) used this task and score method to explore gender differences in spatial orientation ability.
3- Eysenck Personality Questionnaire–Revised (EPQ-R): The participants filled Eysenck personality questionnaire–revised (EPQ-R). EPQ-R is a 100-item scale questionnaire (Eysenck, Eysenck, & Barrett, 1985) that has been developed and revised over a period of 50 years (Francis, Lewis, & Ziebertz, 2006). It measures extraversion, introversion, neuroticism and psychoticism. This is a reliable research tool that is validated in the Iranian population (Afshan, Askari & Manickam, 2015; Biabangard, 1991). This scale measures neuroticism, psychoticism, extraversion-introversion and is a lie detector. The reliability estimates of men and women in Iranian society were reported 0.8 and 0.84 for neuroticism, 0.84 and 0.88 for extraversion, 0.62 and 0.62 for psychoticism and 0.73 and 0.77 for lie detector respectively (Biababgand, 1991). In the present research, questions related to psychoticism and extraversion had been removed from the questionnaires that were given to participants. Those groups of questions were removed due to more concentration on the purpose of this research which obviously was not related to Psychoticism and extraversion.

Procedure

After the participants were selected, they visited a flower garden located in Isfahan, Iran. They had no expectation to be asked to complete a questionnaire and a cognitive task in the end of their visiting. Raw scores were given to the SPPS-18 software to analyze statistically. ANOVA statistical test and correlation coefficient calculation were used to interpret the results.

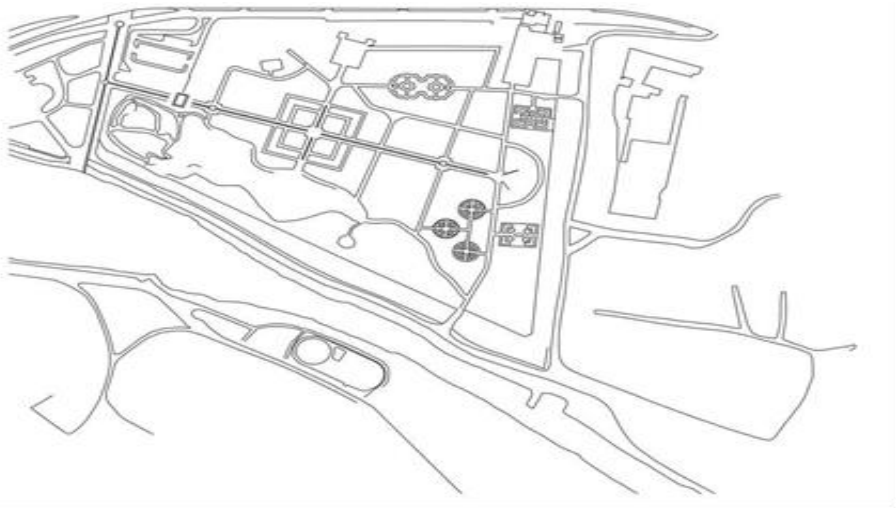

Figure 1.
The Incomplete Map of The Flower Garden located in Isfahan, Iran, designed based on Google Map by Soleimanpour (2016, September 5)

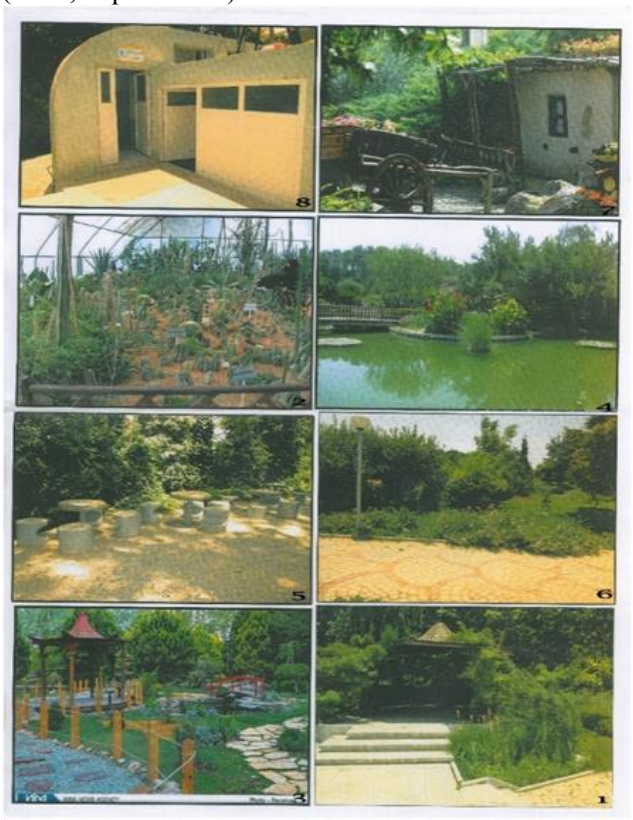

Figure 2.
The Pictures of the Sights that participants had to specify approximate place of them on Incomplete Map. Taken from Hossein pour Najjar (2016, September 2

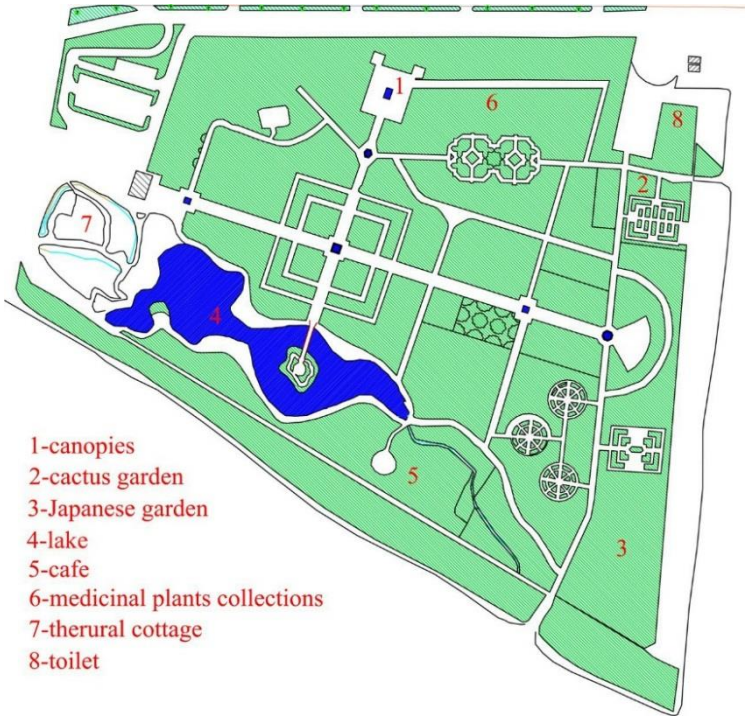

Figure 3.
The Complete Map of The Flower Garden located in Isfahan, Iran, designed based on Google Map by Soleimanpour (2016, September 5)

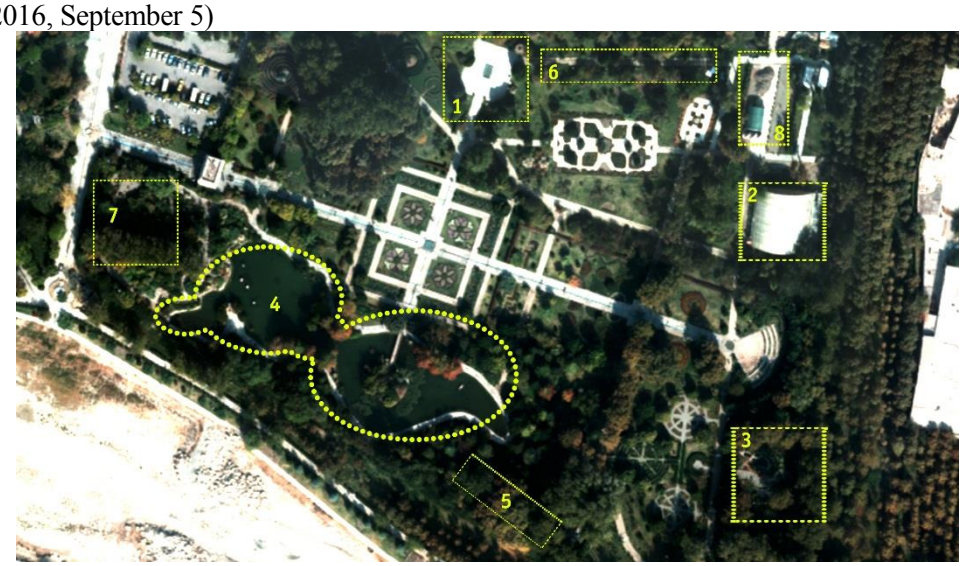

Figure 4.
Aerial Photo of Flowers Garden. Taken from Google Maps (2016, September 5)

(1. Canopies, 2. Cactus Garden, 3. Japanese Garden, 4. Lace, 5. Cafe, 6. Medicinal Plants Collections, 7. Rural cottage, 8. Toilet)

Findings

Descriptive statistics of the participants in this study can be seen in Table 1.

Table 1.
Descriptive Statistics of Neuroticism and Age

Variable		N	Average	Standard deviation	Standard error
	Women	36	5.77	2.69	0.44
Neuroticism	Men	24	3.87	2.67	0.54
	Total	60	5.01	2.82	0.36
	Women	36	24.81	3.80	0.49
Age	Men	24	25.58	3.85	0.40
	Total	60	25.19	3.83	0.45

The results of ANOVA statistical test showed the mean scores of neuroticism in men were less than women (F1, 58= 7.22, P<0.05).

Table 2.
Descriptive Statistics of Memory

Variable		N	Average	Standard deviation	Standard error
	Women	36	1.76	2.10	0.35
Memory	Men	24	3.60	1.05	0.40
	Total	60	2.50	2.23	0.28

As it can be seen at table above, men spatial memory scores were statistically more than women (F1, 58= 11.46, P<0.05).

Table 3.
Analysis of Variance between Men and Women

Variables		Squares total	df	Mean square	F	Sig
	Between groups	52.136	1	52.136		
Neuroticism	within of groups	418.847	58	7.222	7.22	0.009
	total	470.983	59			
	Between groups	48.767	1	48.767		
Memory	within of groups	246.733	58	4.254	11.46	0.001
	Total	295.500	59			

In Table 3, the correlation of spatial memory with the other variables is shown.

Table 4.
The Correlation between Spatial Memory, Neuroticism, and Age

		Neuroticism	Age
Spatial	R	-0.596	0.415
Memory	Sig	0.001	0.001
	N	60	60

There is an inverse relationship between neuroticism and spatial memory (r=-0.59, P<0.01) and positive relationship between age and spatial memory (r=0.41, P<0.01).

Discussion and Conclusion

Regarding the results mentioned above, it can be stated that spatial memory in men is better than that in women (F=11.46, P<0.05). Also, Neuroticism in men is significantly less than women (F= 7.22, P<0.05). A direct and inverse relationships have been discovered between age and spatial memory (r=0.41, P<0.01) and neuroticism and spatial memory (r= -0.59, P<0.01), respectively. According to the results of this research, it seems that neuroticism acts like a bumper and interrupts people's attention to their surroundings. According to the Attention Restoration Theory (ART) in environmental psychology, proposed by Kaplan (1995) a natural environment attracts the attention of people by four features and one of them is fascination.

Fascination is one of the environmental qualities and it can show the capacity of an environment to attract attention automatically and without any

cognitive effort (Steg, 2004). Natural environments always have this feature because our ancestors lived there. It seems that neuroticism does not allow individuals to receive this fascination from this environment. Therefore they can't be attracted by this environment and pay more attention to the spatial aspects of it. According to ART theory, it can be stated that neurotic people are deprived of restorative characteristics of this kind of environment but healthy people are not. All in all, healthy people pay more attention to natural environments and their spatial aspects which is consistent with the results of this research.

Neurotic people acted weaker than healthy people in performing spatial memory task in this research. Men also had better performance in specific spatial memory task of this research, compare to women. These results can be justified based on Men Warfare Theory. Our fathers had to pay more attention to their natural environment, where they lived, which was probably a place like a forest, to save themselves and their family against wild animals' or other tribes' possible attack. They needed better orientation abilities and also ability to specify their living domain and both have close relationship whit spatial memory performance.So men used to pay more attention to their natural environment than women. According to the Women Fertility Theory, Evolution process has changed women in a way that they have acquired less and less spatial ability in their development stages and it has been a positive point for them to not go far away from their vulnerable and dependent children which was found in this research too. Men spatial memory was better than women. Individual's cognitive abilities reach plateau in early adulthood between 30-40 years old and people reach maturing stage. But after 40-year-old cognitive abilities starts to decrease because the weight of the brain starts to decrease as well.

Statistical results showed that with subjects age rise, spatial memory performance increased too and it's important to consider that the age of participant was between 17 till 33 and according to the cognitive development flow, these results are generalizable.

To sum up, regarding foregoing paragraphs, it can be pointed out that spatial memory in men were better than women in natural environments and women were suffering neuroticism more than men. Since individual's cognitive abilities gradually increases to the age of 40, the subjects who were older had better spatial memory function. As a final point, neuroticism disturbs spatial memory to a large extent.

A big restriction of this paper was its sample size that challenged the correct conclusion of the research. Certainly, for presenting more reliable results, more studies must be done with a larger sample size.

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