

Way finding Strategies and Sense of Direction in Local Environment: Exploring Gender Differences

¹Mithilesh K. Tiwari

²Sweta Pathak

³Vikash Kumar

⁴Tushar Singh

⁵Yogesh K. Arya

Navigation is a fundamental human behavior and studies reported that male and female differ (favoring male) in their navigating abilities, strategies, and performance in locating target either on map or computer based simulated tasks (Malinowski, 2001; Astur, Ortiz & Sutherland, 1998). At the same time, few studies reported no gender differences when landmarks were consistently present throughout the task of finding route to the destination in the building. Studies on way finding strategies found that male and female differ in their orientation strategies, where males preferentially use survey orientation strategies with emphasis on distances, vectors, and cardinal directions (e.g. north, west) and Females, on the other hand, are in more favor of route based strategies using topographical features including landmarks and relative directions. Keeping in view, present study is aimed to explore gender differences in wayfinding strategies. Total 112 (53 male and 59 female) students (mean age 19.68 years and age range from 17 to 24 years) enrolled in the graduate course in different colleges of Tilka Manjhi Bhagalpur University, Bhagalpur participated in the present study. Independent t-test showed significant gender differences in two different wayfinding strategies favoring males, suggesting that males use route and orientation strategies better than females depending upon context.

Keywords: Spatial abilities, Navigation, Local Environment

Introduction

Spatial abilities are similar to basic human behaviors like navigating in their environment. Studies have suggested that males outperform females in tasks related to spatial abilities. However, current researchers are now focusing on the practical applications of these differences, such as navigating behavior in the real world.

¹Assistant Professor, Department. of Psychology, S. M. College, Bhagalpur, Bihar, India email: mithilesh303318@gmail.com (Corresponding Author)

²Assistant Professor, Department of Psychology, T. N. B. College, T. M. Bhagalpur University, Bhagalpur, Bihar, India

³Research Scholar, Department of Psychology, Banaras Hindu University, Varanasi

⁴ Assistant Professor, Department of Psychology, Banaras Hindu University, Varanasi, Uttar Pradesh, India

⁵Professor, Department of Psychology Banaras Hindu University Varanasi, Uttar Pradesh, India

Navigation is a fundamental & natural human behavior and defined as the process to orient themselves in space and relocate from one place to another. Studies reported that males and females differ (favoring males) in their navigating abilities, strategies, and performance in locating targets either on maps or computer-based simulated tasks (Malinowski, 2001; Astur, Ortiz & Sutherland, 1998). At the same time, few studies reported no gender differences when landmarks were consistently present throughout the task of finding the route to the destination in the building (Sandstrom, Kaufman, & Huettel, 1998; Lawton, Charleston, & Zieles, 1996).

Literature on navigating behavior suggested two types of knowledge or strategies people preferred in their wayfinding: route knowledge and survey knowledge. Route knowledge is defined as sequential knowledge in which different parts of the route from one location to another are learned in a

sequential way. Whereas survey knowledge is a learning environment in a gestalt way using the cognitive map of the environment, however, both knowledge types are successful in wayfinding but route knowledge is easily disrupted when any element of the route is changed. Survey knowledge being more flexible in accommodating new information about the environment enables users even to deviate from the learned path.

Studies on wayfinding strategies found that males and females differ in their orientation strategies, where males preferentially use survey orientation strategies with an emphasis on distances, vectors, and cardinal directions (e.g. north, west), and Females, on the other hand, are in more favor of route based strategies using topographical features including landmarks and relative directions (e.g. right, left) (e.g. Joshi et al., 1999; Lawton, 1994). These gender differences in spatial ability and orientation strategies are attributed to various factors such as preferences, spatial anxiety, and cultural and evolutionary experiences. Women tend to report more spatial anxiety and use of a relative frame of reference as compared to men while performing a navigational task (Lawton, 1994).

Gender differences in wayfinding and navigational experiences may also be attributed to early developmental experiences. Studies reported that boys and girls have differential experiences in their environment where girls have limited opportunities to explore their environment as compared to boys (Herman, Heins, & Cohen, 1987; Matthews, 1986; Webley, 1981; Hart, 1979; Anderson & Tindall, 1972).

Cultural differences in spatial orientation and navigational strategies are also reported in various studies. Relative frames of reference are dominant in Japanese culture, whereas in the Tenejapan Tzeltal ethnic group, absolute directions are the only available frames of reference (Levinson, 1996).

It appears from the above findings that cultural and developmental experiences are important factors leading to gender differences in adopting particular orientation strategies while navigating in their environment. In most of the rural areas in India, girls are not allowed to as much as boys to explore environment due to various issues such as safety, etc. apart from these, technological advancements lead to various smartphone-based navigational systems such as Google map/Apple map may also have a differential impact on the use of strategy.

Objective

Thus, the present study is planned to explore the gender differences in navigational orientation strategies considering frequency as well as the use of smartphone-based navigational systems in Indian culture particularly in college students of Bhagalpur, Bihar, India.

Method

Sample

A total of 112 (53 male and 59 female) students participated in the present study. All students were enrolled in the different graduate courses in Tilka Manjhi Bhagalpur University, Bhagalpur, Bihar, India using purposive sampling. The mean age of the participants was 19.68 (SD= 1.89) years with age range from 17 years to 24 years. Hindi was the most preferred language of the participants with 69.6% of the total population whereas Angika language is the second preferred language with 14.3 %. Out of 112 participants, 42.9% preferred walking as a means to navigate from home to their college, while 36.6% used an auto rickshaw for travel. 31.1% of participants reported once a week they travel to their local market while 22.3% said that they visited their local once a month. Regarding outside travel, 50.9% reported less than once a month while 28.6% reported once a month they traveled far away. 64.3% participants reported that they traveled without physical map and 80.4% reported that they travel with Google/Apple-type technological maps and navigation systems.

Tools and Measures

1. Demographic Information Sheet: A demographic information sheet was prepared by the authors to collect the relevant information about participants pertaining to the study.

2. Wayfinding Strategies: This questionnaire was developed by Lawton (1994, 1996) in which items from Lawton's Wayfinding Strategy Scale and Indoor Wayfinding Strategy Scale were combined and reworded to develop a cross-cultural measure of wayfinding strategy. This scale is comprised of 14 items measuring two strategies i.e. survey and route strategies for a more general purpose of travelling. These items were rated on a 5-point rating scale, ranging from Not at all true to Very true, to assess the degree to which participants thought that each strategy applied to themselves.

3. Sense of Direction Scale: Santa Barbara Sense of direction scale (SBSOD, Hegarty, Richardson,

Montello, Lovelace, & Subbiaha, 2002) was used in the present study to assess individual's perceived sense of direction, abilities, and preferences on a 7-point scale ("strongly agree" to "strongly disagree"). In present scale, 15 items used to assess participants' such abilities. Internal reliability of the present instrument was found 0.88 and test-retest reliability of the instrument was 0.91 (40 days apart). Out of 15 items, half items were reverse scored.

Results

After getting responses from participants, data were entered and analyzed using SPSS (v. 20.0) and results were presented below.

Table 1 shows the frequency of preferred language of the participants where Hindi is the most preferred language of both male and female participants (54.7% and 83.1% respectively). Studies have reported that people speaking different languages have a different frame of reference in locating objects in space and the Hindi language has a predominantly egocentric frame of reference (Mishra et al., 2009).

Table 1
First Preferred Language

Language	Gender	Frequency	Percent
English	Male	4	07.50
	Female	00	00.00
Hindi	Male	29	54.70
	Female	49	83.10
Angika	Male	15	28.30
	Female	01	01.70
Maithili	Male	0	02.70
	Female	03	05.10
Bhojपुरi	Male	4	07.50
	Female	00	00.00
Others	Male	1	01.90
	Female	06	10.20
Total	Male	53	100.0
	Female	59	100.0

Table 2
Result of Chi square test for independence among variables

Characteristics		Gender				Total		Chi Square	Cramer's V
		Male		Female					
		n	%	N	%	N	%		
Daily Commute	Walking	24	45.30	24	40.70	48	42.90	2.770 (.250) df= 2	0.157
	Two Wheeler	10	18.90	06	10.20	16	14.30		
	Four Wheeler	19	35.80	29	49.20	48	42.90		
Frequency of Local Travel	Once a Month	09	17.00	30	50.80	39	34.80	27.093 (.000) df= 3	0.492
	Once a Week	17	32.10	18	30.50	35	31.20		
	Several times a Week	11	20.80	11	18.60	22	19.60		
	Everyday	16	30.20	0	0.0	16	14.30		
Frequency of Outside Travel	Never	33	62.30	37	62.70	70	62.5	0.292 (0.864) df= 2	0.051
	Once a Month	15	28.30	18	30.50	33	29.5		
	Once a Week	05	9.40	04	6.80	09	8.0		
Use of Physical Map	Yes	16	30.2	24	40.7	40	35.7	1.338 (0.324) df= 1	0.109
	No	37	69.8	35	59.3	72	64.3		
Use of Tech Map	Yes	47	88.7	43	72.9	90	80.4	4.414 (0.055) df= 1	0.199
	No	06	11.3	16	27.1	22	19.6		

Chi-square was computed among different categorical variables and gender to find out the independence if any between them and result was presented in Table 2. It is evident from the table that only for frequency of local travel, males and female showed significant

independence whereas female participants showed more frequency in the once-a-month category and zero percentage for everyday travel. Male participants represented more frequency of local travel in all categories except once a month.

Table 3
Relationship between Gender, Wayfinding strategies, Sense of direction and use of physical and tech Maps

	Orientation Strategy	Route Strategy	Sense of Direction	Physical Map	Tech Map
Gender	-.454**	-.333**	-.091	-.109	-.199*
Orientation Strategy		.607**	.312**	-.054	-.158
Route Strategy			.234*	-.183	-.248**
Sense of Direction				-.101	-.171
Physical Map					.134

*p < .01

**p < .05

Table 3 represent correlation among different variables under the study. Gender was found negatively correlated (Significantly) with orientation strategy, $r(112) = -.454$, $p < .01$, route strategy, $r(112) = -.333$, $p < .01$, and use of tech maps during navigation, $r(112) = -$

.199, $p < .05$. Orientation strategy was found positively correlated with route strategy, $r(112) = .607$, $p < .01$, sense of direction, $r(112) = .312$, $p < .01$. Whereas, route strategy was found positively related with sense of direction, $r(112) = .234$, $p < .05$, and negatively related with use of tech maps, $r(112) = -.248$, $p < .01$

Table 4
Showing result of gender differences using independent t-test

Variables	Gender				t- ratio	df	p Value
	Male		Female				
	M	SD	M	SD			
Orientation Strategy	30.01	6.88	23.27	6.46	5.345	110	.000
Route Strategy	17.16	3.71	14.37	4.22	3.700	110	.000
Sense of Direction	4.79	.811	4.63	.891	.951	110	.344

It is apparent from the table 4 that male and female participants differ significantly regarding use of different wayfinding strategies. Male participants performed better than female participants pertaining use of both types of wayfinding strategies. However, both male and female did not differ significantly from each other in their sense of direction.

Discussion

Gender differences were found in use of two different types of wayfinding strategies namely: orientation and route strategy. Male participants reported significantly higher score in both types of wayfinding strategies in comparison to female participants. Result of present study is partially in line

with the previous findings (Lawton, 1996) where gender differences were reported in use of wayfinding strategies and male found to do better in orientation strategies and female performed better in route-based strategies. But in present study, male participants were found better in use of both type of wayfinding strategies. Lawton and Kallai (2002) in their study suggested one of the possible reasons for gender differences is the degree of independence/freedom given to the male and female participants in the society. According to them, girls were given less freedom than males to explore their environment during childhood due to crime and safety related issues. Boys are more likely to explore their outdoor environment (locally as well as downtown) with fewer restrictions and even they are assigned such works/duties.

In the present study, girls appear to travel (locally) less likely than boys as presented in table 2, which is in congruency of the previous finding and supports gender differences in our study. Participants of the present study are residents of the small city and villages of nearby. Females of the present study travel to their college from home mostly in a dependent way using car/rikshaw/auto in which you need to tell the destination to the driver, and he/she will drop you there.

Females in the present study reported that they often go to college or in local market along with other family members.

Boys are scoring significantly higher in route strategy as well in comparison to girls. This might be because of using technological navigation apps like Google Maps/Apple Maps which present turn-by-turn navigation and are mostly based upon route-based strategies.

References

- Anderson, J., & Tindall, M. (1972). *The concept of home range: New data for the study of territorial behavior*. In W. J. Mitchell (Ed.), *Environmental Design: Research and practice* (Vol 1, pp. 1–7). Los Angeles: University of California Press.
- Astur, R. S., Ortiz, M. L., & Sutherland, R. J. (1998). A characterization of performance by men and women in a virtual Morris water task: A large and reliable sex difference. *Behavioural Brain Research*, *93*(1-2), 185-190. [https://doi.org/10.1016/S0166-4328\(98\)00019-9](https://doi.org/10.1016/S0166-4328(98)00019-9)
- Hart, R. (1979). *Children's experience of place*. New York: Irvington.
- Hegarty M., Richardson A.E., D.R. Montello, Lovelace, K.L. & Subbiaha, I. (2002). Development of self-report measure of environmental spatial ability. *Intelligence*. *30*, 425-447.
- Herman, J. F., Heins, J. A., & Cohen, D. S. (1987). Children's spatial knowledge of their neighborhood environment. *Journal of Applied Developmental Psychology*, *8*, 1–15.
- Joshi, M. S., Maclean, M., & Carter, W. (1999). Children's journey to school: Spatial skills, knowledge and perceptions of the environment. *British Journal of Developmental Psychology*, *17*(1), 125–139.
- Lawton, C. A. (1994) Gender differences in way-finding strategies: Relationship to spatial ability and spatial anxiety. *Sex Roles*, *30*, 765–779.
- Lawton, C. A. (1996). Strategies for indoor wayfinding: The role of orientation. *Journal of Environmental Psychology*, *16*(2), 137-145.
- Lawton, C. A., Charleston, S. I., & Zieles, A. S. (1996). Individual-and gender-related differences in indoor wayfinding. *Environment and Behavior*, *28*(2), 204-219.
- Lawton, C.A. & Kallai, J. (2002). Gender Differences in Wayfinding Strategies and Anxiety About Wayfinding: A Cross-cultural Comparison. *Sex Roles*. *47*, 389-401.
- Levinson S.C. (1996). *Relativity in spatial description and conception. Rethinking linguistic relativity*. Cambridge: Cambridge University Press.
- Malinowski, J.C. (2001). Mental Rotation and Real-World Wayfinding. *Perceptual & Motor skills*, *92* (1), 19-30.
- Matthews, M. H. (1986). Gender, graphicacy, and geography. *Educational Review*, *38*, 259–271.
- Mishra, R. C., Singh, S., & Dasen, P. R. (2009). Geocentric Dead Reckoning in Sanskrit- and Hindi-Medium School Children. *Culture & Psychology*, *15*(3), 386–408. <https://doi.org/10.1177/1354067X09343330>.
- Sandstrom, N. J., Kaufman, J., & Huettel, S. A. (1998). Males and females use different distal cues in a virtual environment navigation task. *Cognitive Brain Research*. *6*(4), 351–360.
- Webley, P. (1981). Sex differences in home range and cognitive maps in eight-year-old children. *Journal of Environmental Psychology*, *1*, 293–302.

Received: 21 July 2023

Revision Received : 25 August 2023

Accepted : 27 August 2023

