

Allocentric and Egocentric Behaviour of People While Wayfinding



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Abstract Wayfinding is a daily task which is associated with efficient manoeuvrability within given space and time. Factors affecting wayfinding can be categorised as external and internal. Current study has been done to understand allocentric and egocentric behaviour of people while wayfinding. The study was conducted in two different phases on the participants of age group 25–45 years old. In the first phase, 180 participants were taken into consideration for asking a face-to-face questionnaire on wayfinding. A real-time experiment was conducted in Pune on another eight participants in the second phase. The area chosen for the experiment was unfamiliar to the participants. Results showed that ability to remember the landmarks differs significantly with the age and does not affect with the gender. Significant correlation found out between individual characteristics of a person and different wayfinding factors. The identified dominant factors which affect wayfinding were—modes of wayfinding, spatial anxiety and environmental factors.

Keywords Allocentric behaviour · Egocentric behaviour · Wayfinding strategy · Navigation · Factors affecting wayfinding

1 Introduction

Wayfinding is a daily task which involves understanding the spatial factors while navigating in an unknown area. Wayfinding involves the ability to navigate successfully across the territory. More specifically, wayfinding is the capability to recognise one's location and approach to the destinations in the environment, both cognitively and behaviourally [1].

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© Springer Nature Singapore Pte Ltd. 2020
BBVL. Deepak et al. (eds.), *Innovative Product Design and Intelligent Manufacturing Systems*, Lecture Notes in Mechanical Engineering,
https://doi.org/10.1007/978-981-15-2696-1_9

Kevin A. Lynch has discovered that during wayfinding cognitive maps of locations are processed by individuals [2] and defined a cognitive map as a mental representation made up of routes, paths and environmental relationships, such as cardinal directions, which an individual uses for making wayfinding decisions [3].

With the help of different methods in the experiment, wayfinding performance can be evaluated. Self-evaluation methods have included revealing one's ability to know directions [4] and describing the different methodologies one uses while wayfinding. Behavioural methods have included evaluating distances, drawing maps of an area, exploring familiar or unfamiliar area [5], giving verbal or written directions [6] and indicating unseen locations in the area [1]. Large number of factors can influence individual's ability to find their way and to realise they have reached to their destination.

1.1 Factors Affecting Wayfinding

Factors influencing wayfinding can be categorised as external and internal factors. External factors include environmental factors like landmarks, street structures, number of buildings in an area, etc. Internal factors include characteristics of people like their ability of wayfinding, their behaviour while wayfinding, and familiarity of the environment [7]. A change in wayfinding behaviour has observed when the area is familiar. Wayfinding behaviour is also influenced by the existence of population. There are four environmental factors that affect wayfinding behaviour: visual access, architectural differentiation, floor plan and signage [8]; Presence or absence of these factors affects the wayfinding performance of a person.

1.2 Allocentric and Egocentric Behaviour

Route and survey knowledge are two main types of spatial knowledge according to the theory of cognitive maps [3]. A sequence of memory about how to get from the starting location to the next place is represented by route knowledge and the gestalt like memory of interconnections between locations is represented by survey knowledge [9]. Allocentric/survey knowledge strategy includes global perspective while egocentric/route knowledge strategy involves local features like landmarks. We explored the behaviour of people while wayfinding, strategies they use while navigating in an unknown area and their spatial knowledge from these previous studies. In the current study, we have focused on these different types of behaviours and have conducted a real-time experiment to understand those, also we have investigated the influence of navigational support on the navigational performance. The following hypothesis was considered:

- (1) Difference between allocentric and egocentric behaviour
- (2) Difference in behaviour between finding a way under stress and without stress
- (3) Correlation between individual characteristics and selection of landmarks of a person while wayfinding.

2 Methodology

Through self-report questionnaire investigation and a wayfinding navigation experiment, the differences between navigational (signs and map) and non-navigational assist, tasks showing wayfinding capabilities and wayfinding strategies (egocentric and allocentric) were explored.

The following study was approved from institutional ethics committee, MIT institute of design, Pune, India. Also consent was taken from all the participants involved in the experiment, while the data we gathered from questionnaire survey was anonymised.

Phase 1. One hundred eighty participants of 25–45 years old were taken into consideration for asking a face-to-face questionnaire on wayfinding. They were college students and professionals from Pune and Mumbai. Questions were based on their ability to remember the landmarks and directions, possibility of taking wrong turn in hurry, tendency to follow the crowd when lost, perceived feeling of confusion due to architectural layouts and behaviour of people while navigating. We also referred Lawton strategy scale (1995) for the questionnaire. A 5-point Likert scale was adopted to estimate the typical wayfinding strategies of the participants.

Phase 2. An experiment was conducted in Pune on another eight participants of 25–35 years old in an unfamiliar area. This age group was preferred because these individuals travel and navigate more due to their daily routine, and they are well versed with the use of wayfinding applications like Google maps and have the cognitive ability to find the quickest possible route. Initial survey of 180 participants proved that Google maps application is mostly used solution for wayfinding; hence, we used that in the second part of the experiment. Thus, Google maps helped to explore survey or allocentric strategy while wayfinding. Two tasks corresponding to the egocentric (route) and allocentric (survey) strategies were given for the experiment:

- (1) The task was to find out the given location without using Google maps (using signage, landmarks and asking people), to return to the initial point and to draw the way travelled (map) on the paper. Area chosen was less crowded.
- (2) The task was to find out the given location using Google maps (without asking people), to return to the initial point and to draw the way travelled (map) on the paper. Area chosen was of more traffic and turns.

The criteria of the experiment and tasks were first explained to the participants. There was no time limitation. Observer was monitoring the activities of the participants throughout the experiment.

Statistical Analysis. The Cronbach's alpha was calculated to check the reliability of the questionnaire which was found to be 0.690 which is good [9]. Statistical analysis of this quantitative research approach was conducted in SPSS version 17. To test the differentiation between the factors related to wayfinding and demographic data like age and gender Mann–Whitney test was executed. Spearman correlation test was performed to examine the association between the various factors related to wayfinding. To get help in information interpretation and to diminish the quantity of factors factor analysis was done on the correlation matrix of the observed variables. It was found that a factor analysis was appropriate when the variables were evaluated with KMO (0.744) and Bartlett's test ($p < 0.001$). The data provided by factor analysis was analysed and used for the further experiment.

3 Results

3.1 Analysis from Questionnaire

Table 1 depicts that there is significant difference in age for the ability to remember the landmarks, but no significant difference found in gender.

Table 1 Differentiation between the factors related to wayfinding with the age and gender

Demographics	Factors	Mann–Whitney U	Z	Asymp. Sig. (2-tailed)
Age	Frequency of visiting unknown places	449.000	−1.033	0.302**
	Ability to remember the landmarks	341.500	−2.613	0.009*
	Ability to remember the directions	384.000	−1.769	0.077**
	Frequency of using online maps	454.000	−0.911	0.362**
Genders	Frequency of visiting unknown places	832.000	−0.088	0.930**
	Ability to remember the landmarks	826.000	−0.161	0.872**
	Ability to remember the directions	778.500	−0.604	0.546**
	Frequency of using online maps	780.000	−0.590	0.555**

*Significant at level $p < 0.05$

**Not significant

Table 2 Correlation test results

Factors	Sig. value (<i>p</i> value)	Type of correlation (<i>r</i> value)
Ability to remember the landmarks—ability to find a way in the dark	0.000	0.390
Ability to remember the landmarks—difference in the experience of travelling a same path with different modes of transport	0.000	0.547
Ability to remember the directions—ability to find a way in the dark	0.000	0.272
Ability to remember the directions—difference in the experience of travelling a same path with different modes of transport	0.000	0.408
Possibility of taking wrong turn in hurry—tendency to follow the crowd when lost while navigating	0.000	0.533
The feeling of confusion due to architectural layouts while wayfinding—ability to remember the landmarks	0.046	-0.149
The feeling of confusion due to architectural layouts while wayfinding—tendency to follow the crowd when lost while navigating	0.034	-0.158

*Significant at $p < 0.05$

Table 2 depicts that the ability to remember the landmarks and directions was significantly correlated to ability to find a way in the dark. People who were able to remember the landmarks and directions agreed for the difference in the experience of travelling a same path with different modes of transport. Possibility of taking wrong turn in hurry was significantly correlated with the tendency to follow the crowd when lost while navigating. The perceived feeling of confusion due to architectural layouts while wayfinding is negatively correlated with the ability to remember the landmarks and tendency to follow the crowd when lost while navigating.

Table 3 represents the three clear patterns of response among the respondents— one pattern of modes of wayfinding (or not), one pattern of spatial anxiety while wayfinding (or not) and one pattern of environmental factors (or not). These independent three tendencies (i.e. not correlated) were considered for the further experiment.

3.2 Analysis of the Experiment

Pre-experiment and post-experiment questionnaires were asked to the participants to test their ability to recall the landmarks, directions and the path they travelled based on the Lawton Wayfinding Strategy Scale.

Table 3 Factor analysis table for wayfinding behaviour

	Factor 1: Modes of wayfinding	Factor 2: Spatial anxiety	Factor 3: Environmental factors
Ability to remember the landmarks	0.814		
Ability to remember the directions	0.808		
Mode of transport while wayfinding	0.740		
Follow crowd when lost		0.859	
Afraid of dark		0.758	
Wrong turn in hurry		0.618	
Contribution of architectural layouts for wayfinding			0.710
Contribution of colours for wayfinding			0.612

Table 4 Representing task analysis in percentage ($n = 8$)

Task	Reaching to the destination (%)	Return to the initial point (%)	Recall and draw (%)	Asked for help (%)
Finding location without using map (Phase 1)	100	67	67	100
Finding location with map (Phase 2)	100	100	33	0

Table 4 depicts task analysis in percentage to complete different tasks like reaching to the destination, return to the starting point, recall and draw the way they travelled. It was also observed that whether they are asking for help to find their way.

4 Discussion

Studies have revealed that the egocentric oriented support mode is usually used by females compared to males [3]. In the present study, Table 1 depicts no significant difference in gender for the ability to remember the landmarks, but it is found in age. Lawton (1996) demonstrated experimentally that participants suffering from spatial anxiety show incorrect landmark identification which is supported by this study. Table 2 depicts that the feeling of confusion due to architectural layouts while wayfinding is negatively correlated with the ability to remember the landmarks and tendency to follow the crowd when lost while navigating.

Studies have revealed that landmarks and sense of direction help to build cognitive model of the area which helps in wayfinding [10]. We must know where we are in relation to the streets and landmarks and we must update this information while moving through the area. Sometimes in the situation of anxiety, fear and stress, this task becomes difficult. The ability to do all these appears to be captured well in the present study of the perception of one's own sense of direction. We identified the comprehensive list of all the factors that affect wayfinding. Table 3 depicts the dominant factors identified—modes of wayfinding, spatial anxiety and environmental factors.

Studies have revealed that a valid component of human wayfinding experience is a sense of direction [11]. Different cognitive processes are involved in finding a way in an environment. The names of streets, blocks, where the streets are located and how they lay in relation to each other must be remembered. Studies have also shown that people in India rarely use maps for navigation. They rely primarily on asking around and navigate using landmarks [12]. In the present study, analysis of the experiment showed in Table 4 depicts that behaviour of people while finding a given location without map (egocentric) and using map (allocentric) was different. Recalling the landmarks, directions and the way they travelled were different in both allocentric and egocentric behaviour of the participants. Most participants reported a greater reliance on route strategy and a low to moderate use of map strategy.

There are few studies which have conducted real-time experiment of wayfinding. In the present study, with the survey and the experiment in real-time environment we observed and analysed wayfinding ability of the people.

5 Conclusion

In this paper, we discussed an egocentric (without using map) and allocentric (using map) wayfinding behaviour in the real physical world. The results showed that the ability to remember the landmarks differs significantly with the age and does not affect with the gender. Also there is difference between egocentric and allocentric behaviour of people while wayfinding. Subsequently, the correspondence between the various factors related to wayfinding was interpreted by the current study. It identified the comprehensive list of all the factors that affect wayfinding. The dominant factors identified were—modes of wayfinding, spatial anxiety and environmental factors.

Large sample size of the participants can be used for real-time experiment in future. This study indicates that technologies supporting egocentric wayfinding behaviour can be useful and can reduce the cognitive load while finding the destination. In future study, other kinds of navigational interface systems can be used. There is a scope of designing and developing a system which will make daily task of wayfinding simpler and which will help to perceive this cognitive process of wayfinding.

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