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# Wayfinding Behaviors In A Healthcare Environment: A Case Study Analysis Of Individual Differences

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**ABSTRACT**

The study aims to examine different movement behaviours between different age group, and gender patients in a healthcare environment during wayfinding ability. Different wayfinding elements and methods are preferable due to the role of various cognitive mapping strategies, which are allocentric and egocentric. In order to analyze wayfinding preferences and abilities of users, questionnaire and sketch questions were asked to 40 participants in Aegean University polyclinics in Izmir, Turkey. A key finding shows that males are more adaptable to allocentric wayfinding elements and females are more convenient to egocentric elements.

**Key Words**: Wayfinding; Perception; Design; Design cognition; User behavior

## 1. INTRODUCTION

Finding a way in an environment is challenging for humans, especially in a large interior environment. Wayfinding failure in a building might result with feeling of disorientation. This failure may occur due to different circumstances [1]. Humans are capable of different methods of wayfinding, depending on the type of the information and considerations of aesthetic and efficiency [2]. Wayfinding describes the process by reaching a goal location by determining a path or a route in the environment. Wayfinding process requires a cognitive or mental map of space. Effective architectural wayfinding clues are resolved during planning strategies. They allow people to quickly comprehend the environment and draw a cognitive map of the context.

Wayfinding task and cognitive mapping process are a phenomenal consciousness both emphasizing the skills with and without the aid of assistive technology. The result of different perceptions among people and cognition of the place varies due to age and gender differences. Wayfinding is a design issue that designers need to take into consideration. Designers and architects have unconsciously practiced wayfinding principles for many years. Different designers named, defined, and quantified wayfinding principles. Kevin Lynch, Romedi Passini and Paul Arthur are three pioneers, largely responsible for the popularization of "wayfinding" term.

According to Lynch, to create a mental impression, there are visual qualities classified into five types of elements; paths, edges, nodes, districts, and landmarks. These elements, with visual accessibility, are the design criteria for highly legible and comprehensible environments. For instance, people make decisions at node points, therefore; nodes should contain architectural information to make decisions [3]. Passini worked on spatial problem-solving in his works, which he co-authored with Paul Arthur. According to Passini, the wayfinding process describes a person's both cognitive and behavioural ability to reach a spatial destination [4].

"Wayfinding decisions are hierarchically structured into plans which not only help to memorize routes in behavioural terms, but help to organize and record environmental information in the form of sequential, route-type representations" [4] (Phrase). When Lynch and Passini are compared Lynch describes wayfinding with environmental zones and geometrical shapes, where Passini explains wayfinding into three-stage performances. Passini starts with (1) decision making,

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continues with (2) decision executing and ends with (3) information processing. Lynch describes wayfinding task with environmental zones and geometrical shapes. Passini formulates and implements wayfinding in the actual plans [5].

During 1970's Cognitive mapping, navigation strategies were classified into two categories by researchers. Men and women use different strategies to perform wayfinding task. Men preferably use strategies based on configurationally information while women use strategies based on route information [6]. First one is Sequential Egocentric (route based) strategy and the second is Allocentric (map based) strategy. Both strategies develop a spatial map; an internal image in the region of the brain called hippocampus [7]. Allocentric and Egocentric strategies are results of functioning different parts of the human brain [8]. Reports of participants are the documents for distinguishing either allocentric or egocentric strategy used during wayfinding. Information from a virtual environment, that participants observe and define the result as Ego-or allocentric. When a participant reports that he notices environmental landmarks or pays attention to environmental elements, then considers himself as primary in the context. This means the participant uses allocentric mapping strategy. If he considers himself as the primary element and pays attention to his movements in the environment, it means that he uses egocentric mapping strategy.

Allocentric navigation strategy is the world centered and based on environmental cues. Things surround human, shape cognitive maps in the brain; in this strategy; built environment is the main clue for navigation [9]. Egocentric mapping strategy can be defined as object location memory and egocentric processes are self-motion information, the viewpoint of the movement is viewpoint-depended [10].

For instance, in Imani and Tabaeian's study [11], they conducted a survey to fifty participants from two gender groups. They were required to draw, sketch maps after visiting the historical region in Isfahan "Haj Mohammad". Their sketch technique was examined in three ways: 1) The frequency of landmarks, paths and notes: This technique gives information about people's internal image of the environment. 2) Accurate placement of the eight target buildings seen on the tour: determines the level of environmental perception. 3) The complexity of the map: shows intelligibility of environment.

The results show the cognitive mapping strategy differences between two genders. At the end of the sketch survey, there were some errors and differences among the maps. Most of the participants' cognitive maps were incomplete, distorted and disproportioned. The main causes of the diversity among the maps were familiarity level and gender differences. For instance, sketch maps of familiar people were more detailed and accurate and female's sketch maps were focused on landmarks and districts, in contrast to men's. Men preferred global references, such as compass points or the position of the sun. Women reported using local preferences such as sequences of the left and right turns and landmarks. Results show that men seem to be better at navigation better than women [11]. These results indicate that women are better at an egocentric type of spatial knowledge, contrast to men who are better at an allocentric type of spatial knowledge. Another study by Sholl et al, [12] shows that male's are more likely to use cardinal directions for navigation. In Hölscher's [13] study, familiar people with the building performed better performance and they reached their goal more quickly. Unfamiliar participants needed to search more clues to orient themselves towards wayfinding elements. Although, Xia et al [14] provided evidence that if the familiarity of the environment increases, the wayfinding behaviours become more economical.

Both studies results show that the role of familiarity and gender affect cognition ability, such as familiarity of space, ease wayfinding task. Female's cognitive mapping strategy is more prone to egocentric strategy. Secure wayfinding gives its possessors an important sense of emotional security and intensity of human experience [3].

## 2. EXPERIMENTAL

### 2.1. Healthcare wayfinding

Healthcare environments are complex spaces with different activities taking place; treatment, inspection, and healing. Besides these activities, healthcare places contain the different units within itself; administrative offices, laundry, kitchen cafeterias, computer memories, technical rooms, mortuary, mechanical rooms and laboratories [15]. A professional should design a better circulation system for buildings with complicated circulation systems. According to Kim [16], hospitals are more liable to changes than other buildings. Multi-functionality makes buildings, complicated and hard to navigate [17]. While designing healthcare facilities, in that respect are some main concerns such as wayfinding and physical comfort [18]. Healthcare facilities are characterized by a high state of anxiety and emotional tension, clarity of the route and wayfinding element should begin from the moment- a patient arrives at the hospital till the patient leaves the building. Developing universal signs in healthcare facilities to aid wayfinding for families and patient is critical especially people from different linguistic backgrounds and cultures [19].

The result of vast changes in the medical world and technology, the design of hospitals has changed up-to-today. As an outcome of rapid changes in the medical world, the standard design of hospitals needs various improvements. Considering the fact that people generally visit hospitals for a diversity of reasons, design can reduce stress [20]. According to Uzunay [21], there are some phases for designing hospitals. The phases are; Planning Decisions, Programming, Designing, Application, and Use. Another criterion that affects the flow of patients in a building is the type of the building and its planning system. In healthcare centre's circulation system, avoiding unnecessary information, like showing organisational elements; landmarks, corridors, intersections are important

principles [22]. The primary principle of circulation theory in healthcare is to protect the patients and employees, especially for handicaps and elder people.

Muhlhausen [5] classifies the wayfinding elements in four separate categories: (1) Architectural Clues, (2) Graphic Communication, (3) Audible Communication and (4) Tactile Communication. In healthcare centres, different types of wayfinding elements may be required, for visually impaired persons navigation, raised tactile boards, tactile compasses, tactile signs, tactile ground surfaces, tactile wayfinding elements. Audible communication elements used for hearing impaired individuals. Çetik and Oğulata's study [23] in Çukurova University Hospital, Turkey, deduces solutions on hospitals workflow, inner patient circulation and wayfinding problems. According to their study, there should be special walkways for blind people to enhance the wayfinding behaviour. Colour bands lead to each department to ease the circulation. However, Olmstead [24] claimed that there is a gap of researches on standardization of public information signs in healthcare environments.

## 3. METHOD

Aegean University (E.U.) is located at Bornova district in Izmir, Turkey. For its outstanding wayfinding problems, the polyclinic building in the campus area selected for the study. A clear mental map and finding the right way in the building are the troubles of the wayfinding task. In practice, potential problems that a user might experience are getting lost, not knowing where you are, and not knowing which direction you came from. In this research, the intercept survey method is applied to obtain reliable data.

### 3. 1. Participants

The full experiment lasted about five to seven minutes for each participant. For better communication, the study was extended out one by one. Table 1. shows the age percentages and frequencies of the participants. Participants were patients in the hospital. The results indicate that 12 participants between 21-30 ages are with the highest percentage (30 %), and three participants over 61 age are the lowest percentage of 7,5 %. The participants gave informed consent.

| Age Groups | Frequency | Percent |
|---|---|---|
| 11-20 | 5 | 12.5% |
| 21-30 | 12 | 30% |
| 31-40 | 7 | 17.5% |
| 41-50 | 8 | 20% |
| 51-60 | 5 | 12.5% |
| 61- | 3 | 7.5% |
| Total | 40 | 100% |

Table 1. Percentages of age groups

### 3. 2. Procedure

The survey took place in two different waiting areas with similar visualizations on the route (Figure 1). Regardless of the direction, the users entered the building from entrance 1 or 2. Their routes from the entrance to destination point were equally same. In each scenario, they observed the same visual elements; one information desk, several wayfinding elements, one inner garden and two decision points. Both paths are shown in Figure 2 and 3.

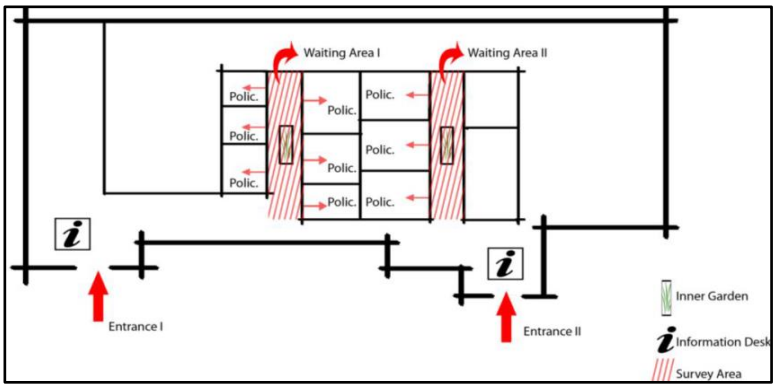


Figure 1. Survey area, entrance, information area and inner garden

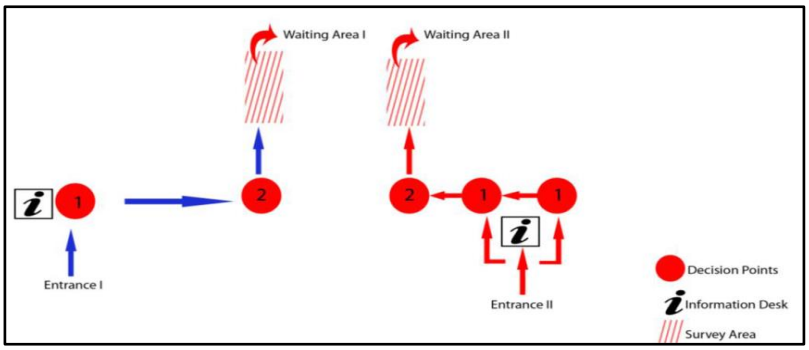


Figure 2. Route 1

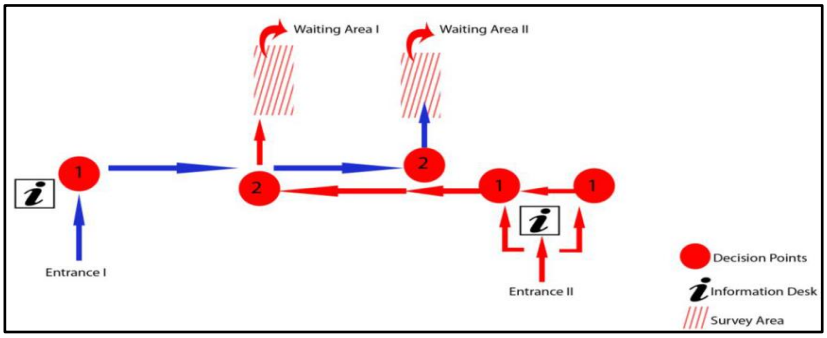


Figure 3. Route 2

The first stage of the survey conducted with two questions. The aim was to attain users' familiarity level of the environment and wayfinding preference in the building.

Question 1) "Have you ever come to the polyclinics of Aegean University before?". The aim of this question was to learn whether the user was a first-time visitor or not. It investigates the role of familiarity with wayfinding ability.

Question 2) In order to acquire wayfinding preference of users', the picture of a YAH map and a signage showed to the participants (Figure 4).


Figure 4. Question 2 illustrations

## 4. RESULTS AND DISCUSSION

### 4. 1. First stage results

Starting with survey results of first question, which is "Have you ever come to the polyclinics of Aegean University before?" show that 14 men and 11 women were first time users. With the distribution of % 62.5 total participants, %70 of men and %55 of women were experiencing the environment for the first time. The result of question one shows that most of the participants were unfamiliar with the environment (Table 2).

| | Men | Women | Total | Percentage |
|---|---|---|---|---|
| First time user | 14 | 11 | 25 | 62.5% |
| Not a first time user | 6 | 9 | 15 | %37.5% |
| Total | 20 | 20 | 40 | 100% |

Table 2. Result of question 1

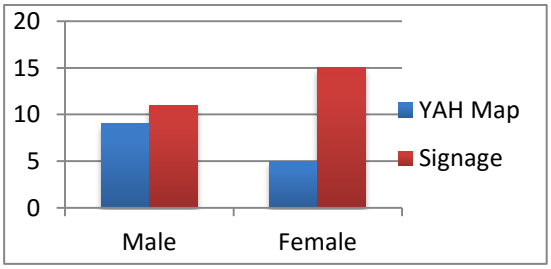


Figure 5 (a). Gender comparison of second question

Question 2 considered the gender and age differences, and its results show that that notwithstanding of gender, the preference of signage is more than YAH maps as a reference guide in a building. In Figure 5 (a) shows that nine women and five men prefer YAH maps, on the other hand, 11 females and 15 men prefer signage method.

As experiments performed by Chen, Chang and Wen-Te Chang [25] show that the tendency of signage is higher than YAH maps. Preference of signage is higher in women since they are more tentative to egocentric mapping strategy. The survey results of E.U. are consistent with Changs' results.

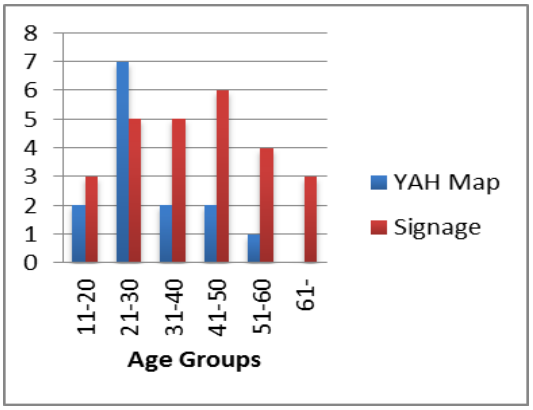


Figure 5 (b). Age comparison of second question

Figure 5 (b) compares six ranges of age groups and their choices between signage and YAH maps. All age groups prefer signage over YAH maps. In age groups of 21-30, they prefer YAH maps over signage, which can be a result of their education system and mass use of advanced computer game technology.

### 4. 1. Second stage results

In sketch part of the survey, participants draw their route from the entry point to the selected waiting area. Sketch results analyzed in three stages. The first stage was a zone drafting, the second was the accuracy of the studies and third was route description styles with different sketch techniques.

#### 4.2.1. Examination of determination of zones on the route

In sketches, female participants indicated more zones than male participants. This can be a result of female's perceiving surrounding environment in a must particulate way. Male participants focused more than females to the target destination. In their sketches, they did not focus on zones or wayfinding elements.

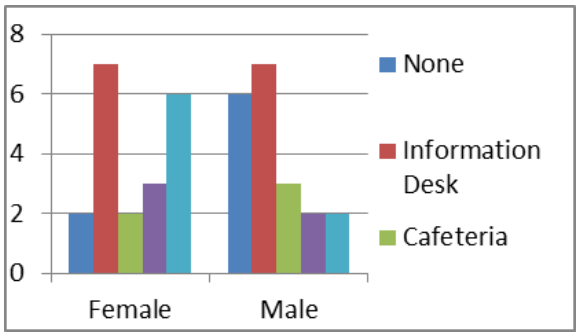


Figure 6 (a). Gender comparison of determination of zones

Both gender's sketches with different ranges; (Figure 6 b), show inner garden, cafeteria, information desk, and other zones (blood donation, elevator, seating area). However, 10% of female and 30% of male participants did not include any zones in their sketches. This can be a result of egocentric mapping strategy of female participants.

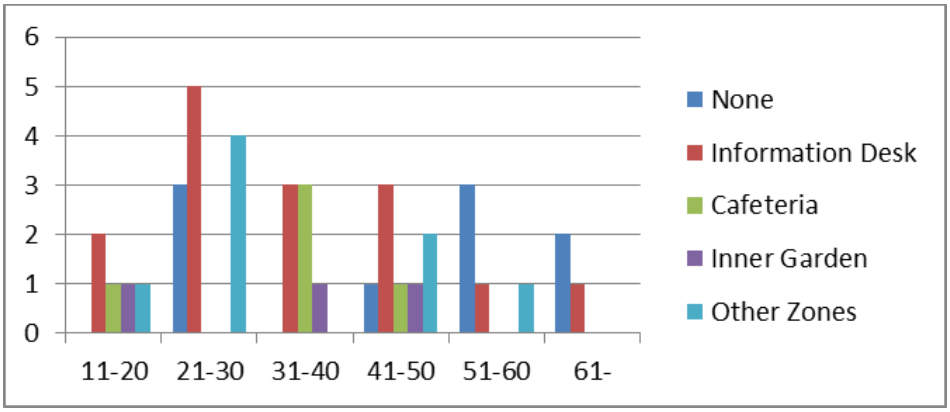


Figure 6 (b). Age comparison of determination of zones

When the results are analyzed according to age groups, solely information desk was shown in the all the sketches; in a particular age group of 21-30 has the high percentage. Also, when the distributions of showing other zones are examined again age group of 21-30 has a higher percentage than other age groups (Figure 6(b)).

#### 4.2.2. Examination of accuracy of the sketches

In this part, the accuracy of sketches analyzed considering gender and age differences of the participants. Accuracy determination criteria are; distortion, proportion, orientation and completeness of the cognitive maps. Accuracy levels are graphically shown in Figure 7 (a) and 7 (b) with comparing genders and age groups.

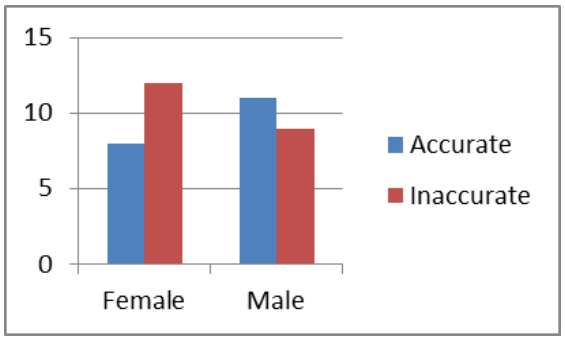


Figure 7 (a). Gender comparison of accuracy of sketches

There was a slight accuracy level difference between two genders. Almost half of the sketches were incomplete and disoriented. Node points and key locations were not available (Figure 7 (a)). Male participants' sketches were slightly more accurate than females' sketches.

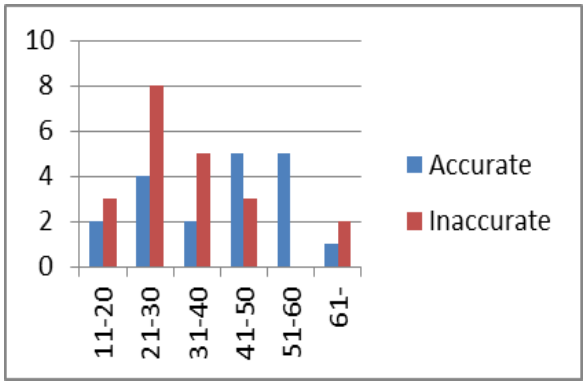


Figure 7 (b). Age comparison of accuracy of sketches

When the accuracy of sketches were evaluated due to each age groups, inaccuracy level highly increases in the ages of 21-30. Since this age group was more prone to showing other zones rather than main areas, the inaccuracy level of their sketches was more prospective.

#### 4.2.3. Examination of route description styles

While analyzing sketches, another criterion was the difference in route description styles. Considering different drawing techniques categorized route description sketches. The first technique was using arrows in sketches. Using arrows means that, they were viewing their body as a center point, which was a result of egocentric mapping strategy. The second technique was using the only path and space-defining factors to show corridors, which implied allocentric mapping strategy. Additionally, using both or none of the description styles is other techniques that the participants applied during the study.

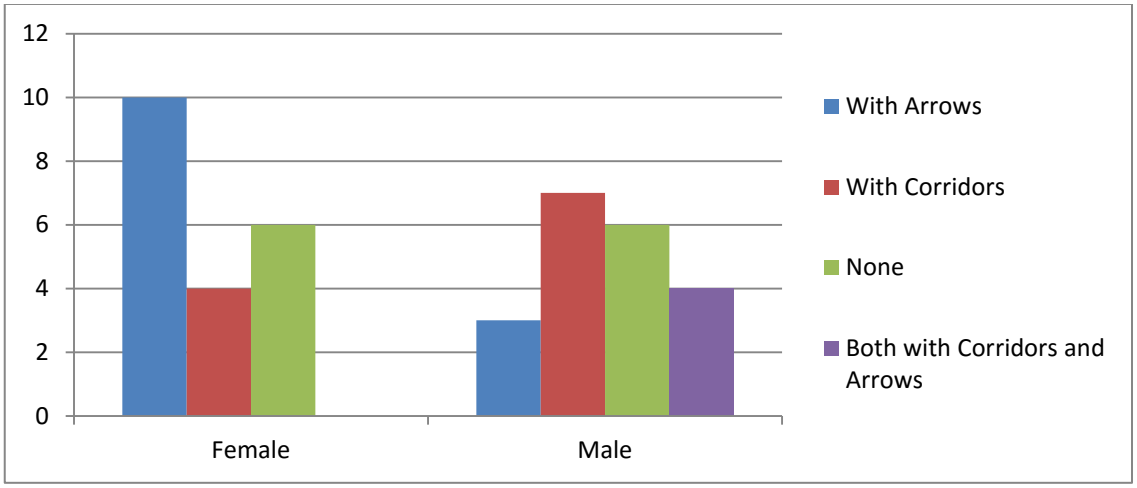


Figure 8 (a). Gender comparison of route description

Figure 8 (a) shows that female participants mostly preferred indicating their route with arrows rather than corridors. Since, they were considering their body positions as a reference point while navigating, which means egocentric strategy. Beside this, some male participants used both egocentric and allocentric techniques.

A sketch study conducted by Chen, Chan and We-te Chang [25], prove that women were better at an egocentric type of spatial knowledge. Also, in that study women participants' sketches consist of arrows, and some male participants' sketches were including arrows and corridors. It means that men are more prone to think both allocentric and egocentric.

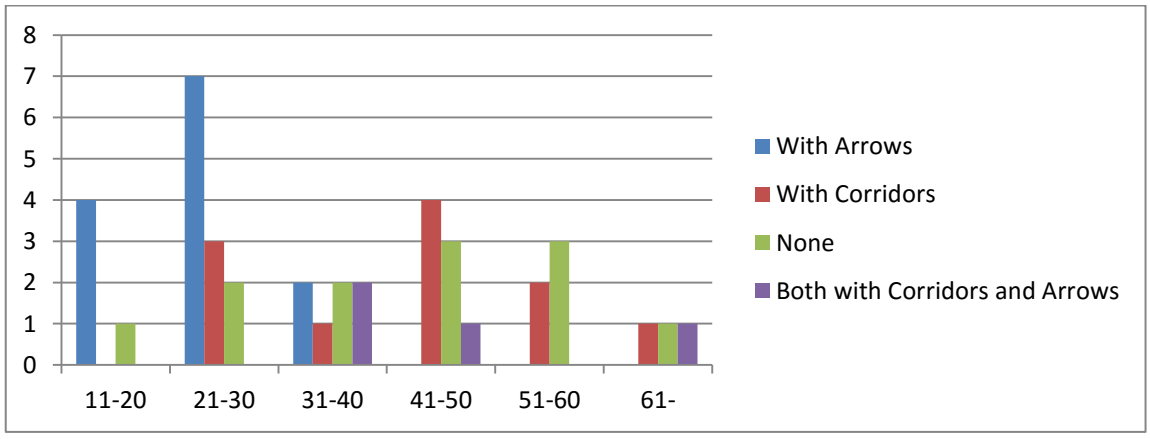


Figure 8 (b). Age comparison of route description

In Figure 8 (b), the increase of egocentric style between 21-30 age group shows that it is overt. Usage of arrows is higher in the ages between 11-31. According to Rodgers's study [26] on allocentric mapping strategy with different age groups, establishes that an ability of allocentric strategy decreases with aging. In contrast to Rodgers's results, in this study allocentric strategy gets apparent in the age of 21-30 and increases with aging. None of the participants, who are older than 40 years old, use the arrows in the sketches.

Here are some sketches to show the difference cognitive mapping strategies. In figure 9, represents the sketches of some participants who explained the route with a body as a reference. Figure 10 shows used arrows sketches of allocentric style.

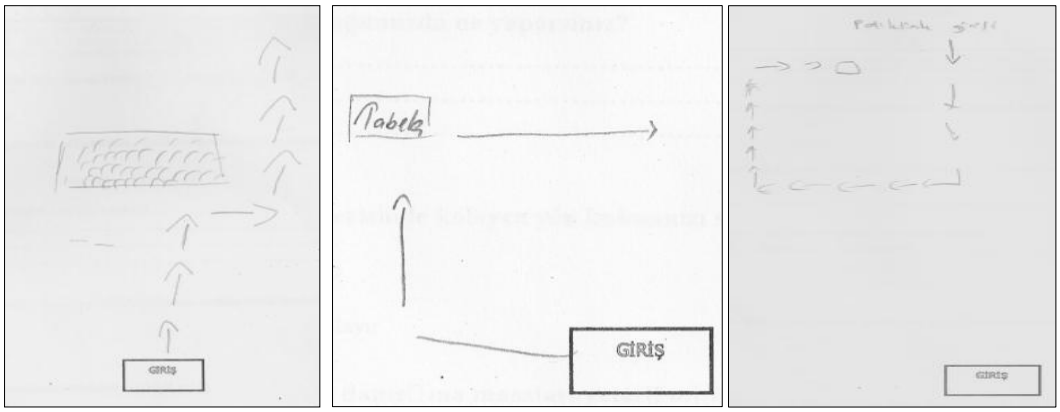


Figure 9. Sketch examples of showing route with arrows (egocentric technique)

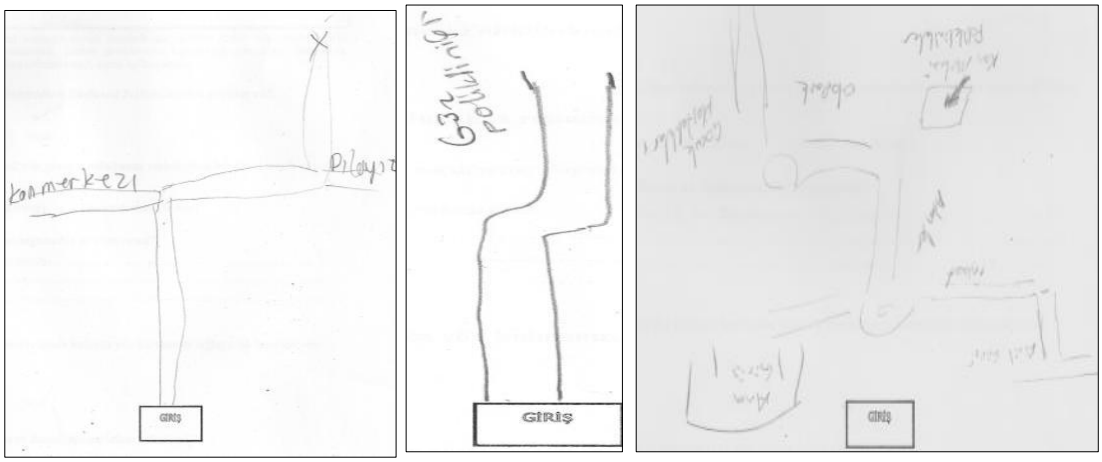


Figure 10. Sketch examples of showing route with corridors (allocentric technique)

## 5. CONCLUSION

In this study, the relationship between cognitive mapping styles and the individual differences studied considering, age and gender difference in healthcare buildings. An in-depth analysis of prior studies reveals several important achievements. During 1960's, Kevin Lynch and Romedi Passini performed pioneering studies on environmental perception and cognition in urban planning. Their study along with following researches brought up new fields for architects to consider like wayfinding elements and cognitive mapping strategies in buildings.

Survey results indicate that differences between individuals' age and genders cause differences among visual perceptions as well. Results also showed that men generally are better at navigating in indoors. Male participants preferred wayfinding strategies like signage more than female participants. They described route strategies relying more on local preferences like left and right turns, landmarks and "You are Here" (YAH) maps. Furthermore, while female participants mostly included other areas such as cafeterias, inner gardens and other polyclinics on their mental maps, most of the male's did not include any other zones in their sketches. Also with aging, the preference of YAH map decreases.

The conclusion of this study brings some essential and interesting possible avenues for future research. For instance the importance of cooperation between wayfinding designers, architects, and cognitive scientist should be considered for having further effective and higher quality circulation flows in buildings. When it's viewed from a more comprehensive perspective in healthcare buildings, there are several more factors to be considered. The selection of wayfinding elements should match with the type of the hospital and users' disability level. The location of information areas should be located on node points. Insights gained from this research should be of interest of designers wishing to generate innovative solutions on wayfinding strategies and the ones that aim to promote cognitive mapping styles for future projects. Wayfinding problems are very important tasks for designers' especially healthcare buildings. It is important to pay close attention to wayfinding design.

Although this study was relatively limited in healthcare environments scope, the findings add to the growing evidence of healthcare facilities for patients. The study also revealed the importance of increasing indoor environmental quality by considering different wayfinding behaviours. These results help confirm previous studies and indicate possible solutions for immediate applications in healthcare facilities.

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