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Analysis of the Correlation Between Layout and Wayfinding Decisions in Hospitals

Hastanelerde Plan Şeması ve Yön Bulma Kararları Arasındaki İlişkinin Analizi

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ABSTRACT

As a research topic of several disciplines such as psychology, sociology, and especially architecture, wayfinding is always on the agenda and is open to research. In this paper, the relationships between the wayfinding decisions of the users in hospitals and the layout of the hospitals were examined on inexperienced users. Hospitals, which are places where people frequently visit and compete over time to gain their health during their visits, are public spaces with the highest circulation of users during the day. For this reason, hospitals were preferred as research areas. Factors affecting the spatial perception of the users during wayfinding were tested in the real space scene. The relationship between wayfinding decisions of users and the layout of the hospital was analyzed by VGA over GoPro camera according to the selected routes. The wayfinding behavior analysis of the users was conducted with the GoPro camera. In addition, the VGA of the plans consisting of routes was performed with Depthmap software. Finally, the numerical data obtained from both analyzes were interpreted using the SPSS 24 statistical package and appropriate digital analysis. As a result of the analysis, it was revealed that the layout of a hospital is effective in the wayfinding decisions of the users due to several spatial variables, and the layout and the wayfinding behavior are closely related.

Keywords: *Hospital designs; perception of space; plan layout; space syntax; wayfinding.*

ÖZ

Son yıllarda başta mimarlığın olmak üzere psikoloji, sosyoloji gibi bir çok disiplinin de araştırma konusu olan yön bulma, araştırılmaya açık gündemde olan bir konudur. Bu çalışmada hastanelerde kullanıcıların yön bulma kararları ile hastanelerin plan şemaları arasındaki ilişki deneyimsiz kullanıcılar üzerinde incelenmiştir. Insanların sıkça ziyaret ettiği ve ziyaret ederken sağlığına kavuşmak için zamanla yarıştığı mekanlar olan hastaneler, gün içersinde en fazla kullanıcı sirkülasyonuna sahip kamusal mekanlardır. Bu yüzden araştırma alanı olarak hastane mekânı tercih edilmiştir. Kullanıcıların yönlerini bulurken mekansal algılarını etkileyen faktörler gerçek mekân sahnesinde test edildi. Kullanıcıların yön bulma kararları ile hastanenin plan şeması arasında ilişki seçilen rotalar üzerinden GoPro kamera aracılığı ve VGA ile incelendi. GoPro kamera aracılığıyla kullanıcıların yön bulma davranış analizi, Depthmap yazılımı aracılığıyla da rotaların yer aldığı planların VGA gerçekleştirildi. Son olarak her iki analizden elde edilen sayısal veriler uygun sayısal çözümlemelerle SPSS 24 istatistik paketiyle yorumlanmıştır. Analizler neticesinde kullanıcıların yön bulma kararlarında hastanenin plan şemasının birçok mekansal değişkene bağlı olarak etkili olduğu ve yön bulma davranışı ile plan şemasının yüksek ilişkili olduğu tespit edilmiştir.

Anahtar sözcükler: *Hastane tasarımları; mekan algısı; plan düzeni; mekan dizimi; yön bulma.*

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Introduction

As an ordinary daily activity, people make plans about where to go and decide the best way to get them where they want. We use our wayfinding skills as long as we move to reach a destination with a desired plan (Gluck, 1991). Although people in these situations reach their goals with a small amount of problems, we know that sometimes people have serious problems in determining direction or finding direction and, these problems result in reaching the wrong goals and getting lost (Hölscher & Brösamle, 2007; Sönmez & Önder, 2015). Wayfinding has been characterized in various studies by introducing the necessary wayfinding strategies to follow this route by plotting a route? between the departure and the destination (Carpman&Grant, 2016; Conroy, 2001; Golledge, 1999). As a process, wayfinding is driven by intrinsic motivation, with a continuous interaction between the way-finder and the space (Allen, 1999). However, in some cases, people do not prefer to enter or go to buildings with complex structures. This is due to the difficulties that people may experience in finding their ways and the fear of getting lost in places with complex structures such as museums, airports, train stations and shopping malls (Bechtel, 2010). Hospitals in particular are among the source of such sort of wayfinding problems. Studies in the field of wayfinding have generally focused on two themes from the perspective of the wayfinder. One of them is the characteristics of the environment the person in, and the other is cognitive perception. It was explained by Norman (1998) as the knowledge existing in the world and the knowledge existing in the mind of person (Norman, 1998). The part of the knowledge that exists in the world is related to the fact that some environmental factors have a reminding and resolving effect on the individual in terms of the structural similarities. According to Norman, earthly knowledge is a type of knowledge that is easy to learn but difficult to use. This is because earthly knowledge is open to continued physical existence, and this being is open to interpretation. Information held in mind is more about organizing, storing, and recalling information when needed. Therefore, the harmony and interpretation of the information available in the environment and the information that the person already holds play an important role in taking the person to the target point he/she designed.

As the first quarter of the 21st century approached, architects began to compete with each other for unique and more challenging design structures for different types of buildings for various purposes. This trend has caused buildings with much more complex interior designs. This is true for most building types, and hospitals are no exceptions and are also affected by this trend. Wayfinding in complex buildings is always considered one of the lifelong challenges that people face to overcome every time they enter an unknown building to navigate (Abu-Obeid, 1998; Ekstrom et al., 2018). In most of the outlets, wayfinding was defined as a human act and the ability to identify one's path to reach a desired destination in a particular daily task (Arthur & Passini, 1992; Conroy, 2001; Lynch, 1960; Raubal & Egenhofer, 1998). As Lynch states, nodes, are cross-section points that contain the basic properties of the main area (Lynch, 1960). In most cases, people encounter various problems while performing this behavior. When they start to feel that they cannot reach where they want on time they experience disorientation s and sense of getting lost (Hölscher & Brösamle, 2007). This action refers to the cognitive and behavioral abilities that individuals use to navigate from one location to another (Palmiero & Piccardi, 2017; Ruotolo et al., 2019). These abilities are formed in conjunction with environmental knowledge or their representatives of knowledge and people's already existing experiences regarding wayfinding (Spiers & Maguire, 2008). This process includes five simple but important aspects as follows: (1) getting to know where one is; (2) successful positioning the desired destination; (3) planning and following the best route to reach the destination; (4) remembering the route used after reaching the destination; (5) and eventually return to the starting point successfully (Janet R Carpman & Grant, 2016; Conroy, 2001; Golledge, 1999). However, hospitals, airports, museums, convention centers and shopping malls are such places where human navigation becomes much more difficult. People avoid going to such places on their own. When people cannot find their way around these structures, they may miss important business meetings and flights, resulting in loss of opportunity and money (Bechtel, 2010). Wayfinding problems are more common, especially in hospital buildings, These problems are costly and stressful, especially for outpatients and visitors unfamiliar with the building (Ulrich et al., 2008). It is a place where people rush to reach their destination as soon as possible, as they may have to catch up with meetings, appointments and may rush to find their relatives or doctors they need to go on time.

Those that defined the five aspects of human abilities may not work as suggested. Human abilities and cognition should be successfully supported by the design elements and successful spatial configurations of buildings (Weisman, 1981). As the floor plans and design elements get more complex, as Başkaya et. al. stated, the wayfinding performance of the users is negatively affected (Baskaya et al., 2004).

More recent studies has indicated that the way buildings planned, and the way spatial areas configured have direct impacts on human cognitive maps (Huelat, 2007; Rooke et al., 2009). Studies has suggested that building plans and spatial configurations determined and designed by considering human senses and human cognition led users to be more confident in wayfinding with less lost frequencies (Huelat, 2007; Rooke et al., 2009). The studies also added that there is a significant correlation between well- designed buildings and compelling adaptation of users to achieve more successful wayfinding behavior (Brunyé et al., 2019). The architectural setting and the logic of the building's design are key to a successful wayfinding. This is associated with the fact that the logical aspects of building designs have a considerable impact on users' ability to understand and remember. (He et al., 2019). To distinguish one part of a building from another part or to perceive the difference of one corridor from another in terms of the intended destination is clearly determined by the effective communication established between the users of a building and the spatial configuration of that building (Janet Reizenstein Carpman et al., 1984; Huelat, 2007). Lawson, defined this phenomenon as "the human language of spaces'', and mentioned that such a language must be considered as the primary focus of attention and should be evaluated in depth by architects and researchers from the perspective of human cognition (Lawson, 2007).

Methodology

Research Questions

In order to achieve the aim of this study, there are three problems that need to be investigated. This paper will focus on:

Q1: How does the symmetrical plan type in the targeted hospital affect the wayfinding behavior of the participants?

Q2: How do the linear circulation areas in the targeted hospital affect the wayfinding behavior of the participants?

Q3: How do the design elements (color, light, landmarks, signage system etc.) in the circulation areas in the targeted hospital affect the wayfinding behavior of the participants?

Experimental Design and Procedures

The aim of this study is to measure the relationship between plan typologies (layouts) in hospitals and the wayfinding decisions of users. For this purpose, answers to the 3 questions given above are sought. For this effect, certain routes were given to the participants within the hospital. While moving towards their destination, it was questioned how the symmetry of the hospital plan affects the users positively/negatively, at which points the users decide to navigate and which spatial factors are effective in the selection of these decision points. In order to find answers to all these questions, a quasi-experimental research environment was created by using qualitative and quantitative research paradigms (Fig. 1).

Wayfinding Behavior Analyses

Data on the wayfinding behavior of the participants were obtained through the GoPro camera. The viewing angle of the participants was calibrated with the angle of view the camera lens. This helped gain a better insight into participants' performance experiences. In order to obtain the data, the routes and job descriptions of the

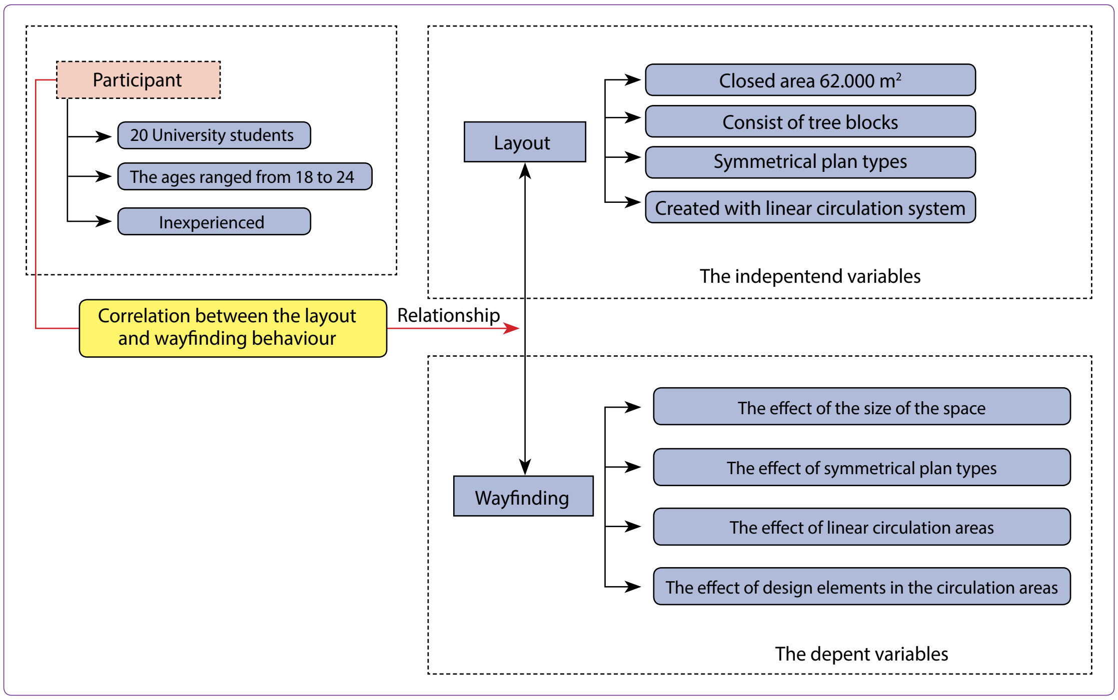

Figure 1. Technical framework of the study.

participants were made on the ground and -1st Floor of the hospital. Participants were first assigned to go to the cardiology department (2) from the outpatient clinic entrance (1) and then to the imaging center (3) on the -1st Floor (Fig. 2). Routes specified according to pre-scans of hospital areas with space syntax analysis and direct observations were determined as the most crowded, longest, challenging, and complex routes in the hospital. Therefore, those routes were chosen as two critical routes that should be given to the participants as route tasks. After the route was determined, the participants were asked to take an envelope from the areas they reached. Each participant who completed his duty returned to the polyclinic entrance with two envelopes. As a result of the experiment, the data obtained through the GoPro camera were revealed by both quantitative and qualitative research methods.

The behavioral analysis method was used for quantitative analysis. Passini (1996) emphasized the need to examine the wayfinding processes to analyze the wayfinding sections and verbal interpretations of basic qualitative research (Passini, 1996). Based on this theory, in the study of Hölscher et al titled “Floor strategy: wayfinding awareness in a multi-storey building” by., each subject was asked to go to 6 points of the building by giving a camera (Hölscher et al., 2004). While walking around the building, the participants were asked to think out loud. At the end of the study, they measured verbal reports and compared them with behavioral criteria. The authors carried out this comparison using 6 variables. Hölscher et al. (2007), Hölscher et al. (2006), Hölscher et al (2005) used the same method in indoor wayfinding studies. (Hölscher & Brösamle, 2007; Hölscher et al., 2006, 2005). Vogels (2015), in his thesis titled “Wayfinding in complex multilevel buildings A case study of University Utrecht Langeveld building”, created the information he obtained with the help of a camera using behavior analysis method (Vogels, 2015). He called this method “wayfinding performance measurement” in his thesis. In this study, the stopping times of the participants were added to the wayfinding performance measurement. Wayfinding behavioral analysis was developed by measuring 7 variables.

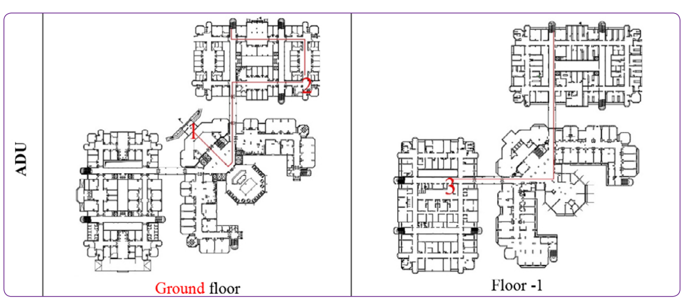

Figure 2. Specified Route-Tasks for both Ground Floor and Floor -1.

1. Time (sec.) (Determined using camera clock)
2. Stops (n) (The number of stops participants need to read the signs or think about which direction to go)
3. Getting lost (n)
4. Distance (m)
5. Distshort (Distance/Shortest route) (Defines unnecessary distance traveled as times of the shortest distance)
6. Speed (Distance/time m/sec.)
7. Stopping times (sec.)

The data of each subject were converted into numerical data based on these variables.

During the qualitative analysis, the sound and images obtained from the camera, the head movements of the participants and after completing their tasks, one-to-one interviews with the participants were examined.

Visibility Graphic Analysis Layout

The data of each subject were converted into numerical data according to these variables. To better determine the relationship between the hospital layout and the wayfinding decisions of the users, space syntax analysis method was used as the second method. Space syntax analysis method is a technique used to explain the spatial models of cities and buildings of different sizes and the organization in space and to examine their interactions with people (Gündoğdu, 2014). The space syntax theory first entered the literature as a method of space reading in 1984 in ‘The Social Logic of Space’ published by B. Hillier and J. Hanson. Relating the social structure and morphological structure, the space syntax theory argues that spaces and social structure are in constant interaction (Hillier & Hanson, 1984). There are several studies on city and building scale to explain the wayfinding behavior through the spatial layouts.(Beros-Contreras, 2007; Haq & Zimring, 2003; Hölscher & Brösamle, 2007; Hölscher et al., 2006; Rafailaki, 2007; Tzeng & Huang, 2009; Vogels, 2015; Wang et al., 2007; Yun & Kim, 2007). In this study, the Visibility Graph Analyzer (VGA), which reveals the relationship between wayfinding behavior and space, was used. The most important syntactic measures are in this analysis are connectivity and integration analysis (Belir, 2012). In the study, the VGA analysis of the ground floor and the -1st floor, where the participants’ task descriptions were made, were performed in Depthmap software.

Data Analyses Procedure

The numerical data obtained from the GoPro action camera and depth map software installed on the participants’ head were analyzed using the SPSS 24 statistics package with appropriate numerical analysis techniques according to the types and levels of the variables. The layout data are classified as space syntax variables. This classification includes connectivity, integration and step depth. Data on wayfinding behavior performance were obtained from time, stops, getting lost, distance, distshort, speed, and stopping times variables obtained from the participants. Therefore, the Pearson Moments product correlation coefficient was calculated between the data obtained by VGA and the data regarding the wayfinding behavior of the participants.

Participants

Participants were 10 female, 10 male students. All of them were from Aydın Adnan Menderes University, and their ages ranged from 18 and 24 and had no previous hospital experience. Participants, throughout the study, were instructed not to use elevators and were only allowed to use stairs whenever and wherever they feel necessary. Another limitation considered for the participants was that they were not allowed to ask anybody questions during their wayfinding tasks.

Experimental Setting

Aydın Adnan Menderes University Training and Research Hospital was chosen as the research area. The hospital has a closed area of 62,000 m² and consists of 3 blocks. Block A is the highest of the blocks with 10 floors connected to each other with tube transition. Blocks B and D are placed symmetrically on both sides of this block. Block B has 5 floors. Block D consists of 4 floors. The most widely used entrance is the Block A polyclinic entrance in the middle, which controls both blocks. Located on the horizontal circulation area, the hospital consists of long corridor connections (Fig. 3).

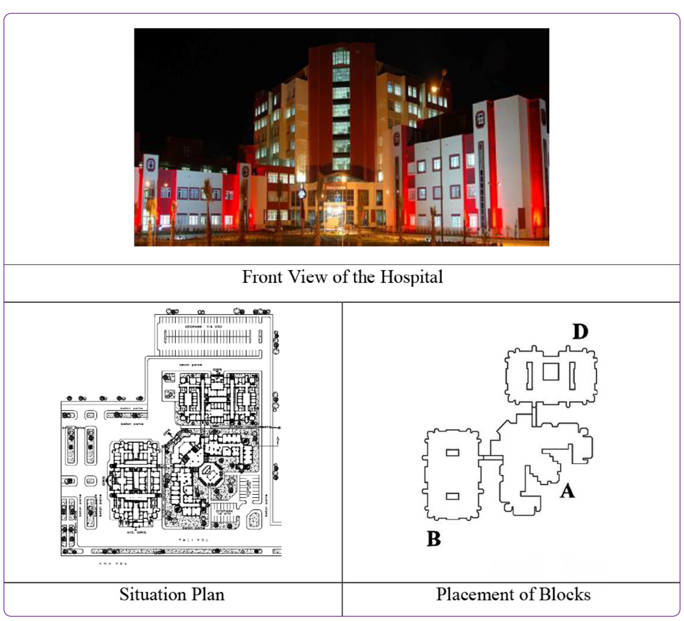

Figure 3. Hospital selected for the field study.

Results

Results for Study 1: Behavior Analyses

The data on the wayfinding behaviors of the participants obtained via the GoPro camera were analyzed by quantitative and qualitative methods. Participants were first asked to go to the cardiology outpatient clinic from the ground floor at the polyclinic entrance, and then to the imaging center located on the -1st floor. The quantitative data obtained were calculated separately for both tasks. Thus, the wayfinding behavior while moving to the destination point on the same floor was compared with the wayfinding behavior shown when moving to the destination point on a different floor. The role of the vertical circulation elements connecting floors each other in the wayfinding behavior was also revealed.

It was observed that the participants took 2 to 11 pauses while going to the cardiology outpatient clinic on the same floor, and the average of these pauses was calculated as 5. The performance parameters for other variables are 21,80 seconds for stopping time. The duration is 3.90 times for the number of getting lost instances, 378.78 m for the distance traveled, 4 times m for the unnecessary route traveled, and 95,52 seconds to complete this route. On the way from the cardiology outpatient clinic to the imaging center on the -1st floor, it is seen that the average time of participants completing this route is 358.05 seconds. The analysis results for other parameters were found as follows: 2.75 times for the number of stops, 19.10 seconds for the stop, 1.45 times for the number of getting lost instances, 323.27 m for the distance traveled, and an average of 1.52 times m for the extra distance travelled and an average of 99.37 s for speed (Table 1).

As a result of quantitative observation analysis, the points where the users stopped to find both destinations were determined. It has been observed that the detected points were the entrance area, nodal points from the circulation areas and long corridor areas, which have an important effect on the spatial configuration of the hospital building (Fig. 4).

When we analyzed the qualitative findings obtained with the Gopro camera, it was seen that the participants

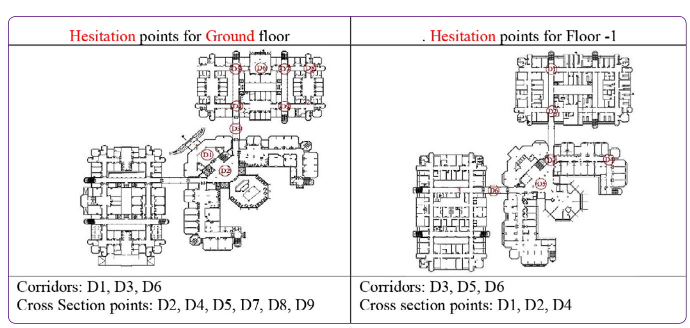

Figure 4. The Hesitation points.

Table 1. Explanatory statistics regarding the performance parameters of the participants

	N	Minimum	Maximum	Mean	Std. Deviation
Ground Floor Time (s)	20	125	1355	474,00	355,988
Floor -1 Time (s)	20	136	910	358,05	208,663
Ground Floor Stops (n)	20	2	11	5,00	2,656
Floor -1 Stops (n)	20	0	6	2,75	1,552
Ground Floor Stop Times (s)	20	4	78	21,80	19,102
Floor -1 Stop Times (s)	20	0	109	19,10	24,694
Ground Floor Lost (n)	20	0	13	3,90	4,217
Floor -1 Lost (n)	20	0	6	1,45	1,986
Ground Floor Distance (m)	20	165,40	1361,95	378,7837	348,00280
Floor -1 Distance (m)	20	220,77	664,08	323,2705	138,08247
Ground Floor Distshort	20	1,42	12,35	4,0150	2,93541
Floor -1 Distshort	20	1,03	3,12	1,5135	0,65034
Ground Floor Speed (m/s)	20	72,37	125,72	95,5150	13,99758
Floor -1 Speed (m/s)	20	69,45	181,22	99,3735	29,83594

turned to the direction sign showing the floors to find the cardiology outpatient clinic, which was their first task point after they entered the polyclinic entrance. It was observed that the users, who looked at the direction sign that containing all the units on the wall surface of the hospital could not distinguish the words clinic and polyclinic, and as a result, they headed to the clinical floors instead of the polyclinic. The design of the hospital in a separate block plan type caused the corridors in the circulation areas to be long. The lengthening of the horizontal circulation caused the users to worry while finding their directions determined by their head movements. It has been observed that the blocks connected to each other by tube passages have symmetrical layouts within themselves and the corridor surfaces do not receive natural light, and the users to have to stop at the nodes to find their directions. It was found that the absence of any design elements in the nodes where they stopped and the characteristic structure of all nodes shaped in a same way caused users to pass the same place several times (Fig. 5).

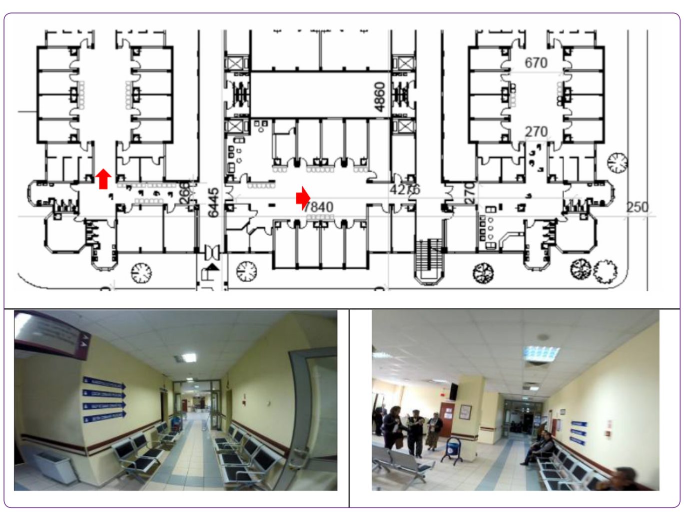

Figure 5. Circulation area.

The pictures hung on the walls of the circulation areas attracted the attention of the users, but it was found that small paintings hung on the long walls were not effective in reminding the ways of returning to the users. (Fig. 6).

It was observed that insufficient artificial lighting in the hospital lower corridors made the wayfinding difficult for the users. In addition, it was determined that the tube passages connecting the blocks were bright areas due to natural light and users feel more comfortable passing through these areas (Fig. 7). It was observed that direction labels were placed on the walls in order to find a solution to the problem of wayfinding arising from the general architectural planning of the hospital, and the users find their direction more easily thanks to the labels placed in these areas.

The presence of waiting units in the narrow corridor areas connecting the polyclinics made it difficult for the users to find the outpatient clinic and reduced the perception their location, especially during the busy hours

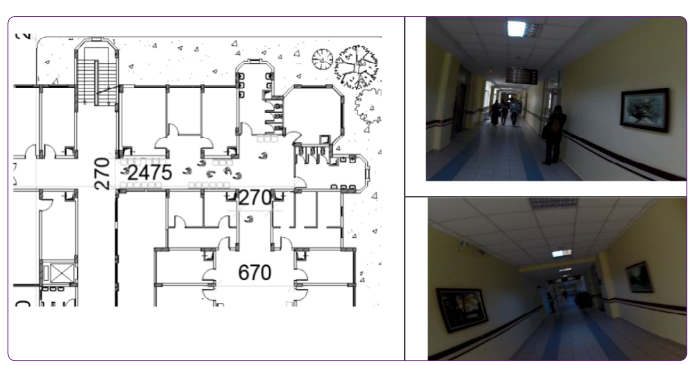

Figure 6. Corridor surfaces.

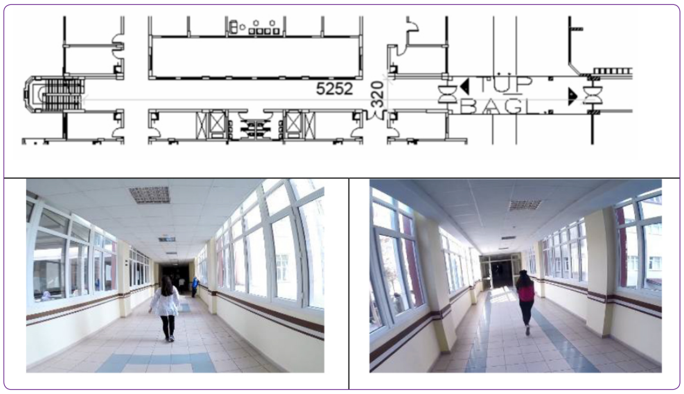

Figure 7. Tube walkway.

of the hospital. It was understood from the conversations in the video recordings that the presence of patient rooms on some polyclinic floors adversely affected the direction perception of the users. Thirteen of the twenty users sought assistance from the hospital staff for the first route determined within the hospital. In total, thirteen users were consulted for fourteen times.

It was observed that the users had difficulty finding the stairs while going from the cardiology outpatient clinic on the ground floor to the imaging center (x-ray) area on the -1^{st} floor. It was determined from the conversations of the camera recordings that the users with previous hospital experience predicted that the x-ray area would be on the -1^{st} floor. It was determined that this situation enables experienced users to save time while finding directions. It was found that the lighting of the -1^{st} floor caused difficulties for the users to find their way to the x-ray area. It was understood from the conversation that the ceiling height on the -1^{st} floor was lower than the other floors, which made the users feel uncomfortable while navigating in the space. It was found that the main circulation corridors on the -1^{st} floor, as on the ground floor of the hospital, were long in the horizontal plane and there are no design elements to help wayfinding, and users had problems in finding their directions and they did not remember the corridors they passed on their way back. In addition, it was observed that the users were directed to the wrong floors by confusing d the concepts of ground, 1^{st} and -1^{st} floors. It was observed that the formation of corridors on both floors was the same, making it easier for users to find the main circulation corridor in line with their experience from the ground floor. Seven of the twenty users asked the hospital staff on how to get from the cardiology outpatient clinic to x-ray area. Users who consulted eight times in total found the target point easier than the ground floor. Another reason for finding the ground floor easily was determined to be the direction signs affixed to the floor. In the post-experiment interview, the users were asked “what was the most helpful factor in trying to find your direction in this hospital?”. The majority of the participants replied “hospital officials and some signboards”. To the question “what was the most important factor which restrained your efforts to find your direction around the hospital?”, majority of the participants answered as “the corridors being dark, the location of stairs and lifts, the corridors having identical plans, and the not distinctive colors on the walls”.

Results For Study 2: VGA

The connectivity, integration, step depth and intelligibility values of the ground and -1^{st} floors of the hospital were obtained via the analysis carried out using Depthmap software. The average values for the space syntax parameters for the ground floor plan of the hospital were calculated as 135.34, 3, and 3.63 for connectivity, integration, and step depth, respectively. The average values for the -1^{st} floor were determined as 106.17, 2.85 and 3.38 for connectivity, integration, and step depth, respectively (Table 2).

When the analysis graphical representation of the ground floor and -1^{st} floor plan of the hospital is examined, it is seen that the layout plans do not have an integrated spatial configuration. It was determined that the connectivity graph was obtained similar to the integration graph. It is seen that the areas with high integrity value (shown in red) are not in the general configuration of the hospital. It has been determined that the places with low integrity value (shown in blue) are planned. As seen in Figure 8, the spaces with high integrity value throughout the plan are node points that are the intersection points of the circulation areas. As we move towards the circulation

Table 2. VGA values of floors for Ground and -1

VGA values	Minimum	Maximum	Average	Std. Deviation
Ground floor connectivity	1	753	135.338	19.40
Ground floor integration	1.7731	5.78997	3.00571	1.70
Ground floor step depth	0	6	3.63193	1.73
Floor -1 connectivity	1	577	106.165	16.10
Floor -1 integration	1.36357	5.41848	2.85454	1.43
Floor -1 step depth	0	8	3.37838	1.22

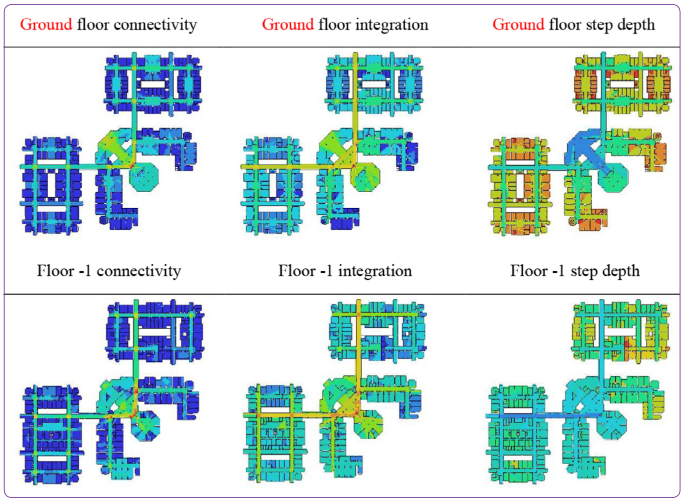

Figure 8. The Graphical Representation of ADU Regarding Ground Floor and Floor -1 in terms of Connectivity, Integration and Step-Depth.

areas connected to high integrity spaces, it is observed that the step depth of the spaces increases while the integrity and connectivity values decrease (Fig. 8).

The data obtained from the observation analysis and the integration scheme of the ground floor and -1st floor plan of the hospital was superposed and the stopping points of the users on the floors were recorded on the integration scheme. It is possible to say that users are more likely to stop at nodes with high integrity value (Fig. 9).

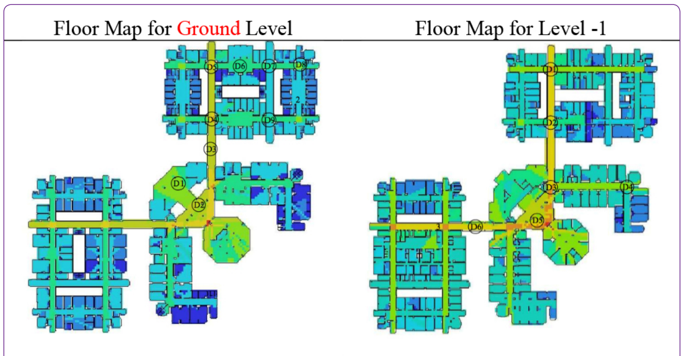

Figure 9. The Representative Image of the Relationship between the Degree of Integration and Stopping Frequencies of Participant.

Results For Study 3: Correlations Between VGA Analysis and Behavioral Analyses

When the relationship between space syntax elements and wayfinding behavior performances was examined, it was found that there was an inverse correlation between connectivity and integrity and participants' completion route, number of stop, stopping time, number of samples got, distance traveled, and extra distance traveled (Table 3). Correlation coefficients were mostly above -0.30, and the relation between them showed significance at 0.01 Alpha level with connectivity and 0.05 Alpha level with

Table 3. Correlation coefficients between performance parameters and space syntax parameters regarding Ground floor

Wayfinding performance		Connectivity	Integration	Step Depth
Time	Pearson Correlation	-,578**	-,504*	,413
	Sig. (2-tailed)	,008	,023	,071
	N	20	20	20
Stops	Pearson Correlation	-,473*	-,397	,362
	Sig. (2-tailed)	,035	,083	,117
	N	20	20	20
Stopping Times	Pearson Correlation	-,142	-,190	,149
	Sig. (2-tailed)	,550	,422	,530
	N	20	20	20
Getting lost	Pearson Correlation	-,316	-,224	,188
	Sig. (2-tailed)	,174	,342	,426
	N	20	20	20
Distance	Pearson Correlation	-,386	-,264	,175
	Sig. (2-tailed)	,093	,261	,460
	N	20	20	20
Distshort	Pearson Correlation	-,499*	-,371	,320
	Sig. (2-tailed)	,025	,107	,170
	N	20	20	20
Speed	Pearson Correlation	,378	,457*	-,392
	Sig. (2-tailed)	,100	,043	,088
	N	20	20	20

*: Correlation is significant at the 0.05 level (2-tailed). **: Correlation is significant at the 0.01 level (2-tailed).

integration. While the connectivity with the number of stops showed a significant relationship at 0.05 Alpha level, another significant relationship was observed between the extra distance traveled and the connectivity again. In other words, the correlation coefficients between connectivity and integrity and wayfinding performance behaviors were not all significant, but the correlation coefficients ranged between -0.30 and -0.70. This shows us that the increase in connectivity and integrity values has a slight effect on duration, number of stops, duration of stops, number of getting lost instances, distance traveled, and extra distance traveled. In addition, the fact that the increase in connectivity and integrity shows linear correlation with velocity, and that this correlation appears as a significant relationship between integrity and velocity at 0.05 alpha level shows that connectivity and integrity are effective on velocity.

Another important finding has been observed between step depth and wayfinding performance behavior. The step depth showed a positive linear correlation with the wayfinding performance behaviors, supporting the connectivity and integrity parameters being in a negative relationship with the wayfinding behavior variables (Table 3). Although the correlation coefficients between step depth and wayfinding performance parameters were not significant at 0.05 Alpha level, they showed that they were associated above 0.30 with the time of stops, duration of stops, and the extra distance traveled. The inverse correlation between step depth and speed is interpreted in the way that an increase in step depth decreases the speed of the participants.

The relationship between the location sequence characteristics of the hospital's floor plan and wayfinding behavior performances was examined, and it was observed that there was mostly a negative correlation between connectivity and integrity, and duration, number of stops, duration of stops, number of getting lost instances and extra distance traveled (Table 4). Although the correlation coefficients are mostly low, when the chart is examined in detail, it is concluded that the increase in these two features of the space syntax influences the wayfinding behavior performance. On the other hand, connectivity shows inverse correlation with velocity, but integrity shows positive correlation with velocity. However, the fact that the correlation loads are very close to zero in both negative and positive aspects is interpreted as the existing relationship being in trace amounts. In terms of step depth, there was always a positive correlation between wayfinding behavior performances. This is a sign that the values in the wayfinding behavior performances increase

Table 4. Correlation coefficients between performance parameters and space syntax parameters regarding -1 floor

Wayfinding Performance		**Connectivity**	**Integration**	**Step Depth**
Time	Pearson Correlation	-,299	-,357	,152
	Sig. (2-tailed)	,200	,122	,522
	N	20	20	20
Stops	Pearson Correlation	-,357	-,529*	-,041
	Sig. (2-tailed)	,122	,016	,863
	N	20	20	20
Stopping Times	Pearson Correlation	-,245	-,560*	-,297
	Sig. (2-tailed)	,297	,010	,204
	N	20	20	20
Getting lost	Pearson Correlation	-,167	-,326	,181
	Sig. (2-tailed)	,482	,161	,446
	N	20	20	20
Distance	Pearson Correlation	-,263	-,493*	,279
	Sig. (2-tailed)	,263	,027	,234
	N	20	20	20
Distshort	Pearson Correlation	-,262	-,492*	,279
	Sig. (2-tailed)	,265	,027	,234
	N	20	20	20
Speed	Pearson Correlation	,359	,059	,220
	Sig. (2-tailed)	,120	,803	,351
	N	20	20	20

*: Correlation is significant at the 0.05 level (2-tailed). **: Correlation is significant at the 0.01 level (2-tailed).

accordingly with the increase in the step depth value. While this relationship, which is positive with wayfinding behavior performances, varies between 10% and 37% in relation to the relationship load, the load of the positive linear relationship between the step depth and the velocity is calculated only as 3%. This can be interpreted as the fact that the probability of a negative load is implied, considering the standard error of this load, which is positive, so that the relationship between them is implied in terms of overall impression. When Table 4 is examined in general, it can be claimed that there are negative and positive, albeit low, relationships between space syntax variables and wayfinding behavior performances.

Discussions and Conclusion

The main objective of the research was to evaluate the relationship between the plan charts of hospital buildings and the wayfinding decisions of first-time users. In line with this goal, three research questions were raised. An experimental environment was created to find answers to these questions. The data obtained from the experiment were evaluated by quantitative and qualitative analysis methods. The results obtained from the evaluation can be summarized as follows:

1) Connectivity, integrity and step depth values related to the spaces affect the wayfinding behavior in that space. The spaces with high integrity value, that is, high accessibility, where the circulation areas are resolved clearly increase the wayfinding behavior of the users positively. On the other hand, in places where depth value is high, and access is difficult wayfinding possibilities of the users deteriorate.
2) It has been determined that the nodes that have high integrity value in the circulation areas and create a wide visual field of view in the space, are the decision-making points where users stop for wayfinding. Therefore, the spatial quality of the joints emerges as an important data set in terms of wayfinding behavior.
3) It has been determined that one of the most important factors that make it difficult for users to find their directions is that the hospital consists of blocks and the blocks have symmetrical layouts. While speaking at the hospital, the users expressed this situation as “I walk down the same corridor as if I was here before”.. In one-to-one interviews, the users stated that the most restrictive factor while trying to navigate at ADU Training and Research Hospital was the shaping of the corridors in the same way. Most corridors of the hospital prolonged the wayfinding time of users because of the lack of design differences such as color and paint on the wall surfaces, causing users to pass through the same place several times without knowing. It is understood from the conversations and head movements that the pictures placed in some areas help users to remember the return path.
4) The quality and colors of the directional signs used in the hospital created difficulties for the users in terms of reading. Scripts written in small fonts on a bright background caused users to lose time during wayfinding. In addition, the fact that the direction signs that should be located at the node points were deployed in different places caused the users to lose time.
5) Keeping the circulation areas of the hospital in narrow dimensions and reaching other places by passing through the places at the end of the corridor increased the step depth throughout the hospital, which negatively affected the wayfinding behavior of the users. In addition, the inadequacy of the waiting areas designed in the corridors and the narrowing of the passage areas misled the users, especially during the busy hours of the hospital.

Corridors with inadequate light caused anxiety among users. The differences in behavior especially when passing through areas with and without daylight, are determined by their speed and head movements. Wayfinding becomes more difficult in areas with poor light. As a result of the findings obtained from the analysis, it has finally been determined that the layout of the hospitals affects the wayfinding decisions. It is a fact that spatial designs have an undeniable effect on the wayfinding behavior as well as the formal plan layout.

- The circulation network of hospitals should be uninterrupted and organized, and the spaces should be created to increase the level of accessibility.
- If possible, it should be ensured that node points benefit from natural light. Increasing the spatial qualities of these areas and including visual design elements that will map the mind of users are important in terms of wayfinding. Direction signs should also be placed at the nodes, which are also points for decision-making..
- Circulation should be positioned in a way to ensure easy access to the locations; instead of passing through one place to another, circulation network should be connected directly to the locations in a way that positively affect wayfinding behavior.
- In addition to the form of a space in the configuration, corridor dimensions should also be taken into consideration, since broadly designed and spaciously resolved corridors (broad shaping of the waiting areas) are an important factor affecting the

wayfinding behavior.. In hospital planning, circulation areas should be shaped so as to benefit from natural light, as far as the space configuration allows.

- More complex spaces should be arranged instead of long corridors. If long corridor surfaces are to be created, attention should be paid to have different colors and textures to separate these areas from each other.
- Direction signs used in the hospital should be written on the floor in a legible and contrasting colors to facilitate perception. In addition, the positioning of the signboards containing the spaces on all floors just opposite the entrance of the polyclinic is an important design input in terms of orientation. After preparing the hospital plans, architects need to do VGA analyzes before implementing in the hospitals. As a result of these analyzes, places with high step depth and low integrity value should be rebuilt or solutions should be offered to these areas by using interior design elements.

This study is important in that it is the first research carried out in our country using GoPro action camera, which was not used before in wayfinding studies. With the study, results that would constitute design inputs for the new hospitals were obtained. It is a good idea to consider all these findings for architects, interior designers and designers during the design phase of hospital building processes. Further studies can be carried out in the city hospitals in our country with samples from people over 60 years old.

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