WAYFINDING IN AN UNFAMILIAR ENVIRONMENT
Different Spatial Settings of Two Polyclinics

AYSU BASKAYA *is currently an assistant professor in the Department of Architecture at the Gazi University, Ankara. She received her M.A. in restoration from the Middle East Technical University, Ankara, and her Ph.D. in architecture from the University of Manchester, School of Architecture. Her research interests include environmental psychology, postoccupancy evaluation, wayfinding, visual perception, and computer-aided architectural design.*

CHRISTOPHER WILSON *is a visiting instructor in the Faculty of Art, Design, and Architecture at Bilkent University, Ankara. He is currently a Ph.D. candidate in architecture at Middle East Technical University, Ankara, where his dissertation will focus on the relationship between architecture and identity, specifically with regard to the catafalque (funeral stage) for Mustafa Kemal Ataturk designed by Bruno Taut in 1938.*

YUSUF ZİYA ÖZCAN *is currently a professor in the Department of Sociology at the Middle East Technical University, Ankara. He received his M.A. and Ph.D. from the University of Chicago. His research interests include police and politics, political behavior, quality of life, migration, occupational structure, crime, and cultural orientations of statistical data analysis.*

ABSTRACT: The purpose of this article is to explore spatial orientation and wayfinding behavior of newcomers in an unfamiliar environment and to emphasize the importance of landmarks and spatial differentiation in the acquisition of environmental knowledge. One setting with a symmetrical layout and regularly organized, monotonous units on different floors and another setting with an asymmetrical layout and repetitive units along one side of a linear corridor of one floor were used to explore different strategies for learning about large-scale spatial environments. Wayfinding performance was found to correlate with performances in sketch-map tasks and the answers of a questionnaire about each building. Most of the participants of the asymmetrical setting could complete a sketch map with a minimum of errors. In the symmetrical setting, however, some participants drew incomplete sketch maps but could find their way through the building with a minimum of errors.

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The degree of familiarity an individual has with a given setting is one obvious and potentially powerful influence on wayfinding behavior. It is known that in an unfamiliar environment complexity might be a serious problem, although initial difficulties in orientation can be overcome. As familiarity with an environment increases, performance in wayfinding and spatial orientation tasks improves both in accuracy and latency (Bryant, 1982; O'Neill, 1992), and the degree of complexity of the layout of the environment becomes less important.

In an environment not previously experienced, the ease with which one can comprehend the spatial configuration of an interior space is a critical component of building coherence. In such a case, navigators rely on numerous types of environmental information to find their way. Environmental psychologist Gerald Weisman (1979, 1981) has looked at the factors that influence wayfinding in buildings and found that plan configuration was the most influential, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers. A strong and significant relationship was found between judged simplicity of plan configuration diagrams and reported frequency of disorientation across the 10 buildings evaluated. C. Lawton (1996) also investigated wayfinding in an unfamiliar indoor environment and found that the participants' strategies yielded three factors—orientation, route, and building configuration—that consisted of using regularity of building layout or room numbers. In fact, in an unfamiliar environment, when people have incomplete cognitive maps, they rely on plan configuration and the scenes that might contain spatial landmarks and spatial properties of the setting, which will all be discussed in the following parts of this work.

LITERATURE REVIEW

Passini (1984) has shown that people can reach their destination even without a comprehensive knowledge of the environment. Similarly, as assumed by Tolman (1948), acquisition of cognitive maps is a necessary condition of adaptive spatial behavior, but people are still adaptive in environments in which they have incomplete spatial representations. People use schemas of typical building layouts to find their way in new settings. As suggested by Gross and Zimring (1992), general knowledge of buildings, in the form of schemas, helps people to orient themselves in unfamiliar settings. Although what constitutes schema-like knowledge and how we recognize a building schema have not yet been made clear, it is possible and easier to wayfind if a building matches a well-known schema. The use of such spatial knowledge was also pointed out by Rovine and Weisman (1989) and by C. Lawton (1996). Using schema-like knowledge enabled their participants, with limited spatial knowledge, to find their way with few errors, and the participants learned routes relatively well in spite of their low level of experience. According to Evans (1998), stress can occur when physical surroundings make the prediction of schema knowledge difficult.

A number of studies suggest that the complexity of floor plan configurations has the greatest influence on wayfinding and perceived legibility (Haq & Zimring, 2003; O'Neill, 1991b). Brown, Wright, and Brown (1997) conducted a postoccupancy evaluation of the wayfinding system in a new pediatric hospital to define the problems of radial floor layouts and suggest solutions. McKean (1972) and Weisman (1981) argued that the ease by which one could form a cognitive map of an environment was related to the simplicity or good Gestalt of floor plan configurations. Symmetry, regularity, and continuity are among those qualities of good form seen as relevant (Canter, 1974). In addition, simple corridor systems and central atrium systems that allow perceptual access between spaces have been linked to positive orientation (M. Lawton, Liebowitz, & Charon, 1970). Arthur and Passini (1992) suggested that buildings organized around an open core have the advantage of providing the users with a visual access to the form of the circulation system. As shown by Dogu and Erkip (2000), people found a mall composed of shops and stores organized around a central atrium to be an easy setting from the wayfinding point of view.

As mentioned in Abu-Obeid's work (1998), having a good floor plan is not enough to help people form clear environmental images unless it is accompanied by pictorial differentiation, which is related to Lynch's (1960) second component of environmental image—identity. Lynch suggested that a legible building telling everything about its internal organization would help users construct schema-like knowledge. According to Appleyard (1969) and Murakoshi and Kawai (2000), when buildings have clear contours and distinctive surfaces that differentiate them from their surroundings, they are more image giving.

In previous research on indoor wayfinding, Passini (1980) found that some people navigating in a large commercial complex relied heavily on the clarity of the organization of the building, whereas others relied more strongly on signage. Peponis, Zimring, and Choi (1990) worked on a hospital with a complex layout and redirected the attention from an exclusive focus on local characteristics, such as signs and landmarks, to one that also considers the overall structure of the building. Their particular suggestion is that wayfinding, assisted by proper signage and proper consideration of functional and organizational parameters, will seem natural rather than forced when important facilities and key points such as the entrance are carefully positioned. Best (1970) stressed the positive relationship between the number of decision points (such as the intersection of two corridors) and wayfinding difficulty. He found that signage placed at decision points of complex buildings improved wayfinding performance. Wener and Kaminoff (1983) reported how the presence of signs significantly reduced perceived crowding, discomfort, anger, and confusion as well as the amount of time spent to complete the process. According to O'Neill (1991a), however, plan configuration was found to be a significant influence regardless of signage, because the wayfinding performance of participants with access to signage in the most complex settings remained equivalent to those in the simplest settings with no signage. Arthur and Passini (1992) have shown that facilitating people's wayfinding requires more than putting up signs, because most of the time signage cannot overcome architectural failures. Similarly Carpman, Grant, and Simmons (1984) found that, with an increase in the number of signs in a hospital hallway, wayfinding performance decreased.

Not only might the overall plan configuration of a building and signage have a considerable impact upon wayfinding behavior, as Gärling, Böök, and Lindberg (1986) have explained, visual access, which is difficult to achieve in a complex layout, is an important factor in facilitating one's spatial orientation and wayfinding. According to Carpman, Grant, and Simmons (1985), the wayfinding behavior of people initially entering a hospital was influenced more by visual access to the destination than by available signage. Seidel's (1982) study at the Dallas/Fort Worth airport confirmed that the spatial structure of the physical environment has a strong influence on people's wayfinding behavior. For passengers arriving at a gate with direct visual access to the baggage claim, wayfinding was easier.

According to Siegel and White (1975), levels of cognitive mapping begin with landmark elements. They proposed that landmark knowledge precedes route knowledge, and both precede configurational knowledge in environmental development. The results of some studies show that route knowledge can be acquired prior to landmark knowledge (Gärling, Böök, Lindberg, & Nilsson, 1981) or even without landmarks at all (Allen, 1988). In general, higher levels of configuration understanding can be associated with more efficient wayfinding performance, but some individuals with poor configuration understanding of an environment can nonetheless easily find their way to a destination within that environment. Some people, however, rely only on landmarks to read the space and identify the position of adjacent spaces (Ornstein, 1992). Weisman (1979), finding that people remember building layouts more accurately if they have visually discriminable subjection, supported this proposal. To give a route instruction, a person may refer only to a landmark, as in, “Go to the big building,” or add relational directions, as in, “Turn left at the bridge” (Pick, Montello, & Somerville, 1988).

RESEARCH CONSIDERATIONS

Polyclinics for outpatients with complex building facilities might present wayfinding problems to the users caused by complicated floor plan layouts. Patients visiting a polyclinic have no previous familiarity with the setting. This puts them in a stressful situation as they find their way from the entrance hall to diagnosis units, from diagnosis units to analysis units, and between diagnosis units. In such situations, wayfinding can also be a difficult task, because many polyclinics are poorly designed, have poor signage, and are densely crowded. Furthermore, it could be argued that wayfinding may be more difficult for patients and visitors than for those visiting other unfamiliar settings because of the stress occasioned, as they are often sick and cannot afford to get lost.

Regarding the polyclinic example, the proposed method of comparing the complexity of wayfinding in their built environments contributes to the question of how people immediately understand and use their spatial environments. This is the reason why participants unfamiliar with the environment were used rather than the actual patients of these settings who may have some experience with the setting. As we suggest, the general understanding of layouts is important to search for specific destinations at the first visit. If the schema that a building has is unknown to people, they cannot orient themselves on their first visit.

It is our suggestion that complex environmental structures can lead to slower development of cognitive maps and also to representational inaccuracies. As shown by O’Neill (1991a), symmetrical form is easier for people to understand and use despite its relatively higher topological complexity. However, what is not suggested in O’Neill’s work is that symmetry can lead to a monotonous environment with repetitive use of elements thus resulting in a lack of confidence in moving through the building and “anxious walking.” In fact, as suggested, a symmetrical layout with repetition and no differentiation can negatively affect wayfinding performance in the first use. This can cause anger, hostility, and indignation. On the contrary, an asymmetrical and legible plan configuration might be enough to facilitate wayfinding even without the needs of pictorial information and landmarks. More particularly, we believe that the necessity of participants for a landmark and/or spatial differentiation in symmetrical, complicated settings with repetition and with no differentiation is superior to that in asymmetrical, uncomplicated settings.

As generally believed in repetitive settings, the more distinct the place, the more easily it can serve as a cue to guide human experience and decision-making behavior. It is our suggestion that monotony of architectural composition and the lack of reference points render wayfinding difficult. At the first exposure to a building, visual access to the main destinations increases the patients' use and facilitates wayfinding. At the later stages of the exposure in complex settings, it is our suggestion that wayfinding decisions must be based on environmental information that is readily accessible so that the patient can proceed from decision point to decision point.

In such a case, a plan layout should be accompanied by an acceptable level of spatial differentiation to identify the distinctiveness of the setting. Arthur and Passini (1992) suggested that distinctiveness may affect wayfinding behavior, which can be achieved by the form and volume of the space and by the use of finishes, textures, lights, colors, and graphics. The uniformity of the symmetrical setting does not serve to support wayfinding unless it is enriched with distinctive landmarks and distinctive paths that allow newcomers to know where they are and how to make their way to desired destinations. Landmarks and/or a zone with a strong character may favor a certain spatial identification in the sense of being somewhere distinct. More particularly, we suggest that areas containing landmarks and various features are unique and can easily be distinguished from other features.

METHOD

PARTICIPANTS

In the first experiment for the Etlik Polyclinic in Ankara, a total of 73 university students (50 female and 23 male) from the Gazi University Department of Architecture were recruited. In the second experiment for the Dicle University Polyclinic, 60 university students from the Dicle University Department of Architecture (20 male and 40 female) were recruited. However, 5 participants from the first and 14 participants from the second experiment were excluded because they had previous experience in the task environment. As shown in Table 1, a total of 68 students from the symmetrical

TABLE 1
Cross-Tabulation of Respondent's Sex With Type of Setting

	Sex		
Setting	*Female*	*Male*	*Total*
Symmetrical	45 39.5%	23 20.2%	68 59.6%
Asymmetrical	11 9.6%	35 30.7%	46 40.4%
Total	56 49.1%	58 50.9%	114 100.0%

setting and 46 students from the asymmetrical setting participated in the experiment.They were all second-year students studying architecture aged between 19 and 20. All were enrolled in classes in the Department of Architecture and were fulfilling a course requirement for participation in an experimental study.

ENVIRONMENTAL SETTINGS

Although wayfinding accuracy is always desirable, there are building types in which the rate of travel is also an important consideration and accuracy to a specific destination more critical. One such facility type is the polyclinic for outpatients through which large numbers of people must efficiently travel between diagnosis and treatment units. Two polyclinics were selected for this study. The first setting was the Etlik Polyclinic in Ankara, which had a composite network design: mainly symmetrical with some regularly organized, monotonous units of different floors and no landmarks. The polyclinic has one main entrance hall with an entrance door for the patients on one of the long edges. The setting, which has two floors, is composed of a management office, an admissions desk, a cafeteria, a pay office, a pharmacy, and toilets organized around a central atrium with a huge skylight. There are ramps connecting the hall to the other floors comprising diagnosis and therapy units and waiting halls. The ramps are placed symmetrically on both sides of the main entrance hall and divide the visual access equally into two parts; one side is for the entrance and the other for the exit or vice versa. Polyclinic units at the back have a regular, repetitive, continuous, and symmetric design with waiting halls on the inside. The only difference between these units is their height; the three at the front are of a doubled height with a square gallery,

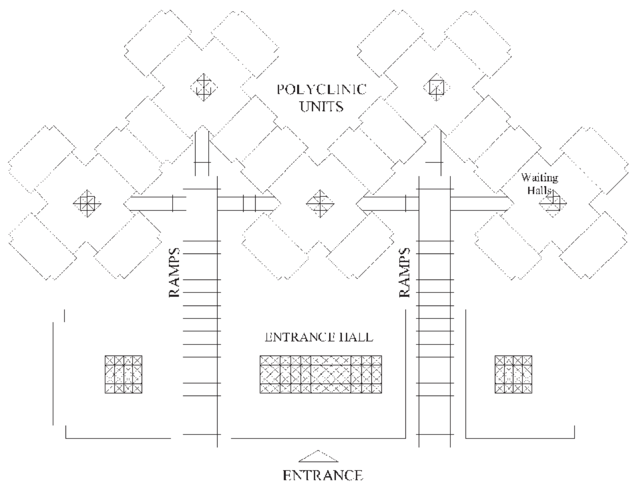

Figure 1: Symmetrical Setting: Social Insurance Corporation (SSK) Etlik Polyclinic

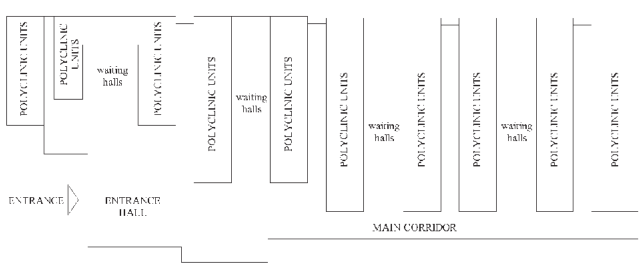

Figure 2: Asymmetrical Setting: Dicle University Polyclinic

whereas the two at the rear are only of a single height. Four similar polyclinic wings surround all waiting halls (see Figure 1).

The second example was the Dicle University Polyclinic, which has a repetitive design with units along one side of a linear corridor on one floor. There is only one main entrance door for the patients, but there are some other doors at the long sides of the corridor for exit purposes only. The entrance door leads the patients to the single-height corridor, which includes an admissions desk, a pay office, a pharmacy, toilets, and also the diagnosis and therapy units and waiting halls. The polyclinic units are divided into five and distributed along the linear corridor, having access from the corridor. The waiting areas are on the left space between the units (see Figure 2).

PROCEDURE

At the beginning of the research for both settings, the students were informed about the different zones in the whole building, that is, a main entrance hall, ramps, and waiting halls for the first setting and a main entrance hall, a main corridor, and waiting halls for the second setting. The participants were taken at the same time to the building and were told to look around for half an hour only and to draw a sketch map at the end. As the aim of this study was to investigate wayfinding behavior with incomplete spatial representation, it was important to encourage the participants to get into the waiting halls with similar representations by just telling them that they had to explain the differences between them. They were encouraged to use the whole building. The main task was to return to the starting point after a 30-minute walk. In detail, the signage system of the settings was not important for this study, because the participants were not asked to find any specific diagnosis units, locations, or landmarks. For each setting, all the participants were observed by five research students doing master's degree work in the same department (Gazi or Dicle).

After arriving back from the settings, the participants were given an explanation of the study and a questionnaire with two tasks: a choice task and a sketch-map task. The choice task concerned the perception of the space inside and the behavior in unfamiliar or unknown environments. For both settings, the same questionnaire was distributed, and measures were obtained for each place reflecting the visual accessibility, accuracy of the spatial layout, and spatial differentiation. Their ideas about symmetry were also asked to learn whether there might be any correlations between them, what is thought about symmetry, and how the building is perceived and interpreted. At the end of the questionnaire, the participants were asked to draw a sketch map on a white sheet of A4 paper. While drawing the map, the participants were not allowed to get any help from photos or any other visual documents. The drawn maps were used as part of the data. Regarding the examples with different settings, sketch maps were evaluated and rated by the authors. Maps with nearly correct placements of the path and items were rated 2, maps with an incomplete path or/and items were rated 1, and fragmental maps or blank maps were rated 0.

DATA ANALYSIS AND RESULTS

An analysis was made regarding the three physical-setting variables. One of them was the visual accessibility at the entrance hall, the second was the

TABLE 2
Cross-Tabulation of Type of Setting With Visual Accessibility at the Entrance Hall

	Setting		
	Symmetrical	*Asymmetrical*	*Total*
Felt completely lost	4 5.9%	2 4.3%	6 5.3%
No idea	9 13.2%	9 19.6%	18 15.8%
Visual accessibility was easy	55 80.9%	35 76.1%	90 78.9%
Total	68 100.0%	46 100.0%	114 100.0%

NOTE: χ^2 = 0.899, *df* = 2, *p* = .638.

orientation and wayfinding in relation to spatial landmarks and signage, and the third was the spatial differentiation such as the need for paintings, sculptures, different use of color, light, and materials that influence orientation and wayfinding in the buildings.

VISUAL ACCESSIBILITY

The degree of visual access to a plan configuration is an important physical setting variable of a legible building. The data presented in Table 2 show that the main entrance hall of each setting was significant and could be perceived from a distance, partly because of the long canopy and gathering area in the front area that marks each entrance. Both of the entrance halls greeted the visitors from the main entrance and gave them high visual accessibility: 80.9% of the participants in the symmetrical setting and 76.1% in the asymmetrical setting found visual accessibility easy (see Figure 3). This accessibility is more enhanced in the first case because of the configuration of the two circulation ramps placed symmetrically on both sides of the main entrance hall.

WAYFINDING IN RELATION TO SPATIAL LANDMARKS AND SIGNAGE

The relationship between the type of setting and parts, which were found impressive by the participants, is given in Table 3. As the probability of the chi-square value indicates, there is a significant relationship between setting type and parts that were found impressive, χ^2 = 40.439, *df* = 3 *p* = 000.

Figure 3a: **Social Insurance Corporation (SSK) Etlik Polyclinic Main Entrance Hall**

Figure 3b: **Dicle University Polyclinic Main Entrance Hall**

Figure 3c: **Social Insurance Corporation (SSK) Etlik Polyclinic Main Entrance Hall**

Figure 3d: **Dicle University Polyclinic Main Entrance Hall**

TABLE 3
Cross-Tabulation of Type of Setting With Impressive Parts of Setting

	Setting		
	Symmetrical	*Asymmetrical*	*Total*
Entrance hall	10 14.7%	8 17.4%	18 15.8%
Ramps/main corridor	45 66.2%	5 10.9%	50 43.9%
Waiting halls	3 4.4%	2 4.3%	5 4.4%
Nothing impressive	10 14.7%	31 67.4%	41 36.0%
Total	68 100.0%	46 100.0%	114 100.0%

NOTE: $\chi^2 = 40.439$, $df = 3$, $p = .000$.

Whereas 66.2% of the participants in the symmetrical setting found the ramps impressive, two thirds of the students in the asymmetrical setting did not find any part impressive (see Figure 4). According to the participants, the ramps provide a good experimental environment, although they make the travel from one point to another a bit longer than other vertical circulation elements (staircases or lifts).

Although the spatial quality of the space was thought to be enriched by the ramps, escalators were suggested by most of the participants to improve the setting. This was never considered before by the authors of this article.

It was not surprising to hear from most of the respondents of the asymmetrical setting that installations applied on the ceilings of waiting halls and circulation ramps made the atmosphere of the inside spaces more stressful and unpleasant. According to the respondents, the floor height of an institutional building must be greater and must also have more natural light.

As for perception during the tour, 63.2% of the participants of the symmetrical setting felt completely lost during the tour as opposed to 6.5% of those in the asymmetrical setting. Complementarily, 11.8% of the participants in the symmetrical setting and 73.9% in the asymmetrical setting indicated that they knew where they were. As the probability of the chi-square value indicates, there is a significant relationship between the type of setting and the perception during the tour, $\chi^2 = 50.993$, $df = 2$, $p = 000$.

Although most of the respondents of the first setting were very impressed with the ramps connecting the floors on both sides of the building (66.2%;

(text continues on p. 855)

Figure 4a: **Social Insurance Corporation (SSK) Etlik Polyclinic Circulation Corridor**

Figure 4b: **Dicle University Polyclinic Circulation Corridor**

Figure 4c: **Social Insurance Corporation (SSK) Etlik Polyclinic Circulation Corridor**

Figure 4d: **Dicle University Polyclinic Circulation Corridor**

Figure 4e: Social Insurance Corporation (SSK) Etlik Polyclinic Circulation Corridor

Figure 4f: Dicle University Polyclinic Circulation Corridor

TABLE 4
Cross-Tabulation of Type of Setting With Perception During the Tour

	Setting		
	Symmetrical	*Asymmetrical*	*Total*
Felt completely lost	43 63.2%	3 6.5%	46 40.4%
No idea	17 25.0%	9 19.6%	26 22.8%
I knew where I was	8 11.8%	34 73.9%	42 36.8%
Total	68 100.0%	46 100.0%	114 100.0%

NOTE: χ^2 = 50.993, df = 2, p = .000.

see Table 3), errors occurred most frequently at the intersection of ramps, as participants could not structure their sense of direction because the areas resembled each other without any landmarks or spatial differences. The ramps were in the form of corridors, and the corridor intersections, where a person must choose between two or more directions of travel, made the route more complicated. The circulation intersections as nodes were the intensive foci to and from which the participants were traveling. That means that a continuity of ramps aid people in orientation and wayfinding, but it was confusing when used both uniformly and symmetrically. Anxiety and fear was observed just after the task, and some of the participants mentioned that they felt as if they would not find their way out at all in half an hour to take the bus waiting outside for them. The authors believe that more confusion was created with the use of such circulation elements, as there is no other vertical circulation element to reach the other units on the other floor except the ramps.

For the asymmetrical setting, the difficulty with orientation and wayfinding was not much, because the main entrance leads the visitors to the main corridor axis. This route certainly indicates the direction of movement and provides an understanding of the circulation in the building. This understanding is enhanced by the absence of other floors and without any use of vertical circulation elements. The participants could also see the exterior, which enabled them to restore their sense of direction. As shown by Gärling et al. (1986), views of the external environment can enhance the legibility of interiors. In fact, 73.9% of the participants of the asymmetrical setting said that they knew where they were during the tour (see Table 4).

TABLE 5
Cross-Tabulation of Type of Setting With Presentation of the Sketch Maps

	Setting		
	Symmetrical	*Asymmetrical*	*Total*
Fragmental maps/blank maps	7 10.3%	4 8.7%	11 9.6%
Incomplete route/elements	51 75.0%	14 30.4%	65 57.0%
Correct placement of route and elements	10 14.7%	28 60.9%	38 33.3%
Total	68 100.0%	46 100.0%	114 100.0%

NOTE: $\chi^2 = 27.172$, $df = 2$, $p = .000$.

The participants were asked to draw a sketch map of the whole building. As the probability of the chi-square value indicates, the sketch map is related statistically to the type of setting. Participants in the asymmetrical setting sketched the layout correctly four times more than those in the symmetrical setting (14.7% and 60.9%, respectively). Whereas 85.3% of the participants in the symmetrical setting presented fragmental, blank sketches or maps with incomplete routes/elements, this percentage was only 39.1% for the participants in the asymmetrical setting. Because of the ramps covered with translucent glass, the participants in the first setting could not see the exterior of the building from most of the route, and this prevented them from structuring the schema knowledge of the whole building. The observers mentioned that all 68 of the participants, however, started from the ramp placing on the right side of the hall and returned back from the left one. Their answers revealed that symmetrical building configurations with repetitive units, although enabling users to find their way through, did not allow them to draw a complete sketch map. Similar to a study by Passini (1984), the participants were asked to sketch the layout of a large commercial complex, often producing distorted representations, yet were able to navigate successfully through the complex (see Table 5).

The participants of the asymmetrical setting could see the exterior, which enabled them to restore their sense of direction, as defined in the work of Murakoshi and Kawai (2000). In sum, the results indicate that the degree of sketch-map drawing ability was higher when the setting was less complicated and asymmetrical.

The respondents' performance on the sketch map was very much related to that of perceiving the structure of the environment. To investigate the joint effects of presentation of the sketch maps and perception during the tour in general, the two variables have been cross-tabulated by controlling for the type of setting. There was a statistically significant relationship (p = .003) between the sketch-map drawing and the perception of space in the case of the symmetrical setting (see Table 6). Approximately 50% of those participants were successful in sketching a correct map, whereas only 7% of the participants who felt lost drew a correct map. This indicates a strong relationship between perception and map sketching. In fact, 88.4% of the respondents in the first setting who felt lost during the tour could draw an incomplete route and/or elements. However, there does not seem to be any relationship (p = .089) between perception of the setting and sketch-map drawing in the case of the asymmetrical setting. Nevertheless, a much higher percent of participants who knew where they were drew correct sketches of the setting (50% in the symmetrical vs. 70.6% in the asymmetrical setting). Because the interaction term is significant, the data indicate that plan complexity is an effective means of decreasing both the schema drawing and the perception.

The participants were also asked for their ideas about symmetry to find out whether there might be any relation between what is thought about symmetry and how the building was perceived and interpreted. It was interesting to see that, among the six alternatives, most of the participants in both settings (52.9% and 52.2%, respectively) chose balance as an indication of symmetry (see Table 7). About 16.2% of the participants identified equality, whereas 13.2% indicated each power and plainness in the symmetrical setting. Comparatively, 21.7% indicated plainness and 19.6% equality in the asymmetrical setting as an indication of symmetry. Even if symmetry means "very well articulated form with balance" to its users, it is possible to conclude that there is an increase in error as plan complexity increases.

THE NEED FOR SPATIAL DIFFERENTIATION

In each example, the participants were asked to comment on the physical quality of the setting. As shown in Table 8, there is a statistically significant relationship (p = .000) between type of setting and its perceived quality. Approximately 30.9% of the participants in the symmetrical setting and 21.7% in the asymmetrical setting found the setting repetitive and boring. Considerable differences were observed between participants in the two experiments in terms of developing an idea about the physical quality of the

TABLE 6
Presentation of Sketch Maps With Perception During the Tour by Setting Type

		Perception			
Setting	*Sketch Map*	*Felt Completely Lost*	*No Idea*	*I Knew Where I Was*	*Total*
Symmetrical	Fragmental maps/blank maps	2 4.7%	4 23.5%	1 12.5%	7 10.3%
	Incomplete route/elements	38 88.4%	10 58.8%	3 37.5%	51 75.0%
	Correct placement of route and elements	3 7.0%	3 17.6%	4 50.0%	10 14.7%
	Total	43 100.0%	17 100.0%	8 100.0%	68 100.0%
Asymmetrical	Fragmental maps/blank maps	1 33.3%	2 22.2%	1 2.9%	4 8.7%
	Incomplete route/elements	1 33.3%	4 44.4%	9 26.5%	14 30.4%
	Correct placement of route and elements	1 33.3%	3 33.3%	24 70.6%	28 60.9%
	Total	3 100.0%	9 100.0%	34 100.0%	46 100.0%

NOTE: Symmetrical setting: $\chi^2 = 16.002$, $df = 4$, $p = .003$. Asymmetrical setting: $\chi^2 = 8.069$, $df = 4$, $p = .089$

TABLE 7
Cross-Tabulation of Type of Setting With Ideas About Symmetry

	Setting		
	Symmetrical	*Asymmetrical*	*Total*
Plain	9 13.2%	10 21.7%	19 16.7%
Confusion	0 0%	3 6.5%	3 2.6%
Equality	11 16.2%	9 19.6%	20 17.5%
Power	9 13.2%	0 0%	9 7.9%
Contradiction	3 4.4%	0 0%	3 2.6%
Balance	36 52.9%	24 52.2%	60 52.6%
Total	68 100.0%	46 100.0%	114 100.0%

NOTE: χ^2 = 13.926, *df* = 5, *p* = .016.

setting and finding it impressive. About 17.6% of the participants in the symmetrical setting and 63% in the asymmetrical setting could not develop any idea about the physical quality of the setting. Similarly, 51.5% of the participants in the symmetrical setting and 15.2% in the asymmetrical setting found their respective settings impressive. The circulation routes certainly indicated the direction of movement and provided an understanding of the circulation in the building, but it seems that it was not easy to find a certain space located in one of the units, which cannot be perceived easily because of its location in the uniform setting. In fact, there was a lack of zone definition for each polyclinic unit. Each waiting hall resembled each other and things were all the same wherever you were. The participants found the recognition of places in terms of the waiting halls insufficient. According to the results, frequent error occurred while distinguishing eight waiting halls that were all shared by two or more diagnosis units connected to each other by ramps and/or through each other. Comparatively, the data indicated that 63% of the respondents of the asymmetrical setting, however, had no idea about the physical quality of the setting (see Table 8 and Figure 5).

A question was asked to determine the respondents' opinion about the effects of different presentations, both in the symmetrical and the asymmetri-

TABLE 8
Cross-Tabulation of Type of Setting With Physical Quality of the Setting

	Setting		
	Symmetrical	*Asymmetrical*	*Total*
Repetitive and boring	21 30.9%	10 21.7%	31 27.2%
No idea	12 17.6%	29 63.0%	41 36.0%
Impressive	35 51.5%	7 15.2%	42 36.8%
Total	68 100.0%	46 100.0%	114 100.0%

NOTE: χ^2 = 26.355, *df* = 2, *p* = .000.

cal settings. In the asymmetrical setting, more than half of the participants (52.2%) indicated that signage was enough, whereas only 5.9% of the participants in the symmetrical setting agreed with this idea. The need for landmarks was expressed by 69.1% of the participants in the symmetrical setting, whereas this value was 39.1% in the asymmetrical setting. One fourth of the participants in the symmetrical setting and 8.7% in the asymmetrical setting expressed that the form needed to be different (see Table 9).

Binary logistic regression analysis was performed to uncover factors that affected wayfinding behavior. Success in map sketching was used as a proxy for wayfinding after being recoded into two groups as incomplete sketchers (default category) and complete sketchers. Participants in the symmetrical setting had 0.03 times less chance than the participants in the asymmetrical setting to draw a complete map (see Table 10). However, this interpretation should be read with reservation because the Wald value is unexpectedly high. The sex of participants is not significant, meaning that the sex of the participant had no influence on sketching a complete map. Participants who had no idea visually at the entrance hall were 0.01 times less likely to draw a complete map compared to those who felt that visual accessibility was easy. Again, the likelihood of drawing a complete map for participants who had no idea about the physical structure of the setting was 0.07 times less compared to those who found the structure impressive. Goodness of fit of the model is significant at the .058 level (Hosmer and Lemeshow test), and the model explains 42% of variation (Nagelkerke R^2). The model classifies 81.6% of the participants correctly (see Table 10).

Figure 5a: Social Insurance Corporation (SSK) Etlik Polyclinic Waiting Hall

Figure 5b: Dicle University Polycinic Waiting Hall

Figure 5c: Social Insurance Corporation (SSK) Etlik Polyclinic Waiting Hall

Figure 5d: Dicle University Polyclinic Waiting Hall

TABLE 9
Cross-Tabulation of Type of Setting With Necessity for a Difference in the Settings

	Setting		
	Symmetrical	*Asymmetrical*	*Total*
Signage is enough	4 5.9%	24 52.2%	28 24.6%
Landmarks have to be used	47 69.1%	18 39.1%	65 57.0%
Form has to be different	17 25.0%	4 8.7%	21 18.4%
Total	68 100.0%	46 100.0%	114 100.0%

NOTE: χ^2 = 32.226, *df* = 2, *p* = .000.

CONCLUDING REMARKS

As shown in the work with incremental increases in floor plan complexity, architecture students, who should be much better at wayfinding than the everyday person on the street, had great problems understanding spatial layout and reduced wayfinding performance. In this spirit, topological complexity appears to be an important environmental variable that has the capability of influencing the overall legibility of the environment and the connections between places. As mentioned at the beginning of this article, Gross and Zimring (1992) believed that general knowledge of buildings, in the form of schemas, helps people to orient themselves in unfamiliar settings. However, the Social Insurance Corporation (SSK) Etlik Polyclinic example does not match a well-known schema. That puts its newcomers into a stressful position, and the complexity of floor configuration has the greatest influence on wayfinding and perceived legibility. The architecture of the building does not lend itself to an easily mentally represented environment because of its lack of landmarks and personalization of the intersections on the ramps as well as its lack of spatial distinctiveness in the waiting halls.

According to the results, Dicle University Polyclinic, with a regular but asymmetrical floor plan, was easier to remember and learn than a regular and symmetrical layout. In fact, a simple corridor system allowed for easy orientation, and a simple layout facilitated both the formation and execution of travel plans by making it easier to choose destinations and routes and learn about the environment. However, regarding the results of the second setting,

TABLE 10
Results of Binary Logistic Regression

	B	SE	*Wald*	df	*Significance*	*Exp*(B)
Setting (symmetrical)	–3.516	0.799	19.351	1	.000	0.030
Sex (female)	0.252	0.583	0.187	1	.665	1.287
Visual			6.513	2	.039	
Visual (felt lost)	0.097	1.004	0.009	1	.923	1.102
Visual (no idea)	–2.382	0.941	6.405	1	.011	0.092
Physical			4.435	2	.109	
Physical (repetitive and boring)	0.097	0.666	0.021	1	.884	1.102
Physical (no idea)	–1.468	0.816	3.238	1	.072	0.230
Constant	1.817	0.769	5.582	1	.018	6.156

spatial quality was the main concern of the respondents, because very few of them were impressed with the setting.

Compared to Dicle University Polyclinic, the condition was much more serious at Etlik Polyclinic in which none of the waiting halls visited by the participants was mentioned as being distinguishable from other spaces or having landmark value. Uniformity, both in the design of spaces and the spatial elements, seems to affect the newcomers' spatial orientation and wayfinding. As suggested by Gärling et al. (1986), the lack of differentiation in a particular environment is expected to affect not only the newcomers' spatial orientation and wayfinding but that of more experienced users, as well. In this respect, symmetrical forms that might be thought less complex (because they contain redundant information) are seriously deficient when used uniformly with more repetitive units.

The results of this study support the idea that a symmetrical layout with repetitive units must be used in accordance with landmarks and spatial representations, which may help a person to recognize places when plan configuration is complicated. As reference points, entrances, colored and decorated waiting halls, and even the elements of the circulation system such as stairs, ramps, or elevators are a prerequisite to understanding the spatial organization of a building. They may all provide directional information to remind the first users of where the facilities are located and how to return to their points of origin. Apart from that, to enhance the rate of perception between similar organizations, graphic information can be applied to make the space more distinguishable and for reassurance. However, when the graphic information tries to compensate for a complicated building configuration, as in the example of Etlik Polyclinic, chaos might appear. As a result, both the graphic and spatial representations as landmarks should be complementary.

As mentioned in the literature review, illegible public buildings might induce stress by producing confusion and a feeling of incompetence. They might generate problems that people encounter in their wayfinding. Theoretically, designers have largely ignored the potential role of the designed environment to contribute to human health. Making wayfinding easier for the first-time users of polyclinics requires that the space be designed in such a way that it facilitates people's structuring processes of tasks. Accordingly, for future polyclinic designs, it is recommended that the building layout be organized regularly and continuously, even symmetrically, while giving each space a different pictorial appearance, that is, a different identity. Regarding Etlik Polyclinic, because the circulation intersections and waiting halls were not distinct, the easiest way to incorporate some differentiation within the setting is to use decorative elements such as color codes as reference points to make each space different from another. This proposal is supported by Abu-

Obeid (1998) and also by Evans (1980) in their findings that building interior memory improves with the use of color schemes. Actually, the nondistinctiveness of the waiting halls was the case in both examples. They need revision not only to make each of the rooms different from one another but also to change the perception of space from the user's point of view (Arneill & Devlin, 2002), which was not the subject discussed in this work. Overall, to make the users feel less disturbed, polyclinic designers must cope with providing architectural guidance in overcrowded situations while improving spatial quality of spaces that are complementary.

REFERENCES

Abu-Obeid, N. (1998). Abstract and scenographic imagery: The effect of environmental form on wayfinding. *Journal of Environmental Psychology*, *18*, 159-173.

Allen, G. L. (1988). The acquisition of spatial knowledge under conditions of temporospatial discontinuity. *Psychological Research*, *50*, 183-190.

Appleyard, D. (1969). Why buildings are known. *Environment and Behavior*, *1*, 131-156.

Arneill, A. B., & Devlin, A. S. (2002). Perceived quality of care: The influence of the waiting room environment. *Journal of Environmental Psychology*, *22*, 345-360.

Arthur, P., & Passini, R. (1992). *Wayfinding: People, signs and architecture*. New York: McGraw-Hill.

Best, G. A. (1970). Direction-finding in large buildings. In D. Canter (Ed.), *Architectural psychology* (pp. 72-91). London: RIBA.

Brown, B., Wright, H., & Brown, C. (1997). A post-occupancy evaluation of wayfinding in a pediatric hospital: Research findings and implications for instruction. *Journal of Architectural and Planning Research*, *14*(1), 35-51.

Bryant, K. J. (1982). Personality correlates of sense of direction and geographical orientation. *Journal of Personality and Social Psychology*, *43*, 1318-1324.

Canter, D. (1974). *Psychology for architects*. New York: Wiley.

Carpman, J., Grant, M., & Simmons, D. (1984). *No more mazes. Research about design for wayfinding in hospitals*. Ann Arbor: University of Michigan Hospitals, Patient, & Visitor Participation Project.

Carpman, J., Grant, M., & Simmons, D. (1985). Hospital design and wayfinding: A video simulation study. *Environment and Behavior*, *17*, 296-314.

Dogu, U., & Erkip, F. (2000). Spatial factors affecting wayfinding and orientation: A case study in a shopping mall. *Environment and Behavior*, *32*, 731-755.

Evans, G. W. (1980). Environmental cognition. *Psychological Bulletin*, *88*, 259-287.

Evans, G. W. (1998). When buildings don't work: The role of architecture in human health. *Journal of Environmental Psychology*, *18*, 85-94.

Gärling, T., Böök, A., & Lindberg, E. (1986). Spatial orientation and wayfinding in the designed environment: A conceptual analysis and some suggestions for post occupancy evaluation. *Journal of Architectural and Planning Research*, *3*(1), 55-64.

Gärling, T., Böök, A., Lindberg, E., & Nilsson, T. (1981). Memory for the spatial layout of the everyday physical environment: Factors affecting rate of acquisition. *Journal of Environmental Psychology*, *1*, 263-277.

Gross, M. D., & Zimring, C. (1992). Predicting wayfinding behavior in buildings: A schema-based approach. In Y. E. Kalay (Ed.), *Evaluating and predicting design performance* (pp. 367-378). New York: John Wiley.

Haq, S., & Zimring, C. (2003). Just down the road a piece: The development of topological knowledge of building layouts. *Environment and Behavior*, *35*, 132-160.

Lawton, C. A. (1996). Strategies for indoor way-finding: The role of orientation. *Journal of Environmental Psychology*, *16*, 137-145.

Lawton, M. P., Liebowitz, B., & Charon, H. (1970). Physical structure and the behavior of senile patients following ward remodeling. *Aging and Human Development*, *1*, 231-239.

Lynch, K. (1960). *Image of the city.* Cambridge, MA: MIT Press.

McKean, J. (1972). University of Essex: Case study. *Architects Journal*, *156*, 645-667.

Murakoshi, S., & Kawai, M. (2000). Use of knowledge and heuristics for wayfinding in an artificial environment. *Environment and Behavior*, *32*, 756-774.

O'Neill, M. J. (1991a). Effects of signage and floor plan configuration on wayfinding accuracy. *Environment and Behavior*, *223*(5), 553-574.

O'Neill, M. J. (1991b). Evaluation of a conceptual model of architectural legibility. *Environment and Behavior*, *23*, 259-284.

O'Neill, M. J. (1992). Effects of familiarity and plan complexity on wayfinding in simulated buildings. *Journal of Environmental Psychology*, *12*, 319-327.

Ornstein, S. (1992). First impressions of the symbolic meanings connoted by reception area design. *Environment and Behavior*, *24*, 85-110.

Passini, R. (1980). Wayfinding in complex buildings: An environmental analysis. *Man-Environment Systems*, *10*, 31-40.

Passini, R. (1984). Spatial representations: A way finding perspective. *Journal of Environmental Psychology*, *4*, 153-164.

Peponis, J., Zimring, C., & Choi, Y. K. (1990). Finding the building in way-finding. *Environment and Behavior*, *22*, 555-590.

Pick, H. L., Montello, D. R., & Somerville, S. C. (1988). Landmarks and the coordination and integration of spatial information. *British Journal of Development Psychology*, *6*, 372-375.

Rovine, M. J., & Weisman, G. D. (1989). Sketch-map variables as predictors of wayfinding performance. *Journal of Environmental Psychology*, *9*, 217-232.

Seidel, A. D. (1982, July). *Wayfinding in public spaces: The Dallas/Fort Worth airport*. Paper presented at the 20th International Congress of Applied Psychology, Edinburg, Scotland.

Siegel, A. W., & White, S. H. (1975). The development of spatial representations of large-scale environments. In H. W. Reese (Eds.), *Advances in child development and behavior* (pp. 234-285). New York: Academic.

Tolman, E. C. (1948). Cognitive maps in rats and men. *Psychological Review*, *55*, 189-209.

Weisman, G. D. (1979). *Way-finding in the built environment: A study in architectural legibility.* Unpublished doctoral dissertation, University of Michigan, Ann Arbor.

Weisman, G. D. (1981). Evaluating architectural legibility: Wayfinding in the built environment. *Environment and Behavior*, *13*, 189-204.

Wener, R., & Kaminoff, R. (1983). Improving environmental information: Effects of signs on perceived crowding and behavior. *Environment and Behavior*, *15*, 3-20.