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Pedestrian Path Choice with Diagonal Streets

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Abstract

The aim of this study is to investigate pedestrian path choice between diagonal and straight streets. We selected 16 streets including both straight and diagonal streets in Seoul for this study. We then investigated the environments and structures of these streets and surveyed pedestrians about which streets they would choose when they had no destination. First, the participants tend to choose diagonal streets. Second, street angle and street width were identified as the structural factors that had the strongest effects on path choice among diagonal streets. Some environmental factors were also found to be significant: presence of sidewalk, road pavement type, commercial use, presence of street trees, and use of the acute angle plot at an intersection. Overall, the results indicated that some structural and environmental factors associated with diagonal streets affected the pedestrian path choice.

Keywords: path choice; street structure; pedestrian; diagonal street; walking

1. Introduction

Walking has been gaining attention as a transportation mode that provides health benefits and builds social capital (Leyden 2003). Walking can play a great role in relieving traffic congestion, conserving resources and vitalizing communities, while encouraging physical activity can help reduce obesity, diabetes, and cardiovascular disease (Blanco *et al.*, 2009). In order to motivate people to walk more, their enjoyment of walking needs to be taken into consideration. The street environment experienced by pedestrians is one pleasure of walking. These environments can include various views and interests. In terms of street structure, Lim (2007) mentioned that the perception of whole cities can be improved by a simple road grid pattern; however, there are concerns that this would decrease the diversity of cities. In this respect, diagonal streets are one of the elements that can make monotonous streets more varied. Acute angle plots between straight and diagonal streets also have various types and uses.

When people choose their routes to a particular destination they prefer shorter routes (Borgers and Timmermans, 2005; Kawada *et al.*, 2014). Diagonal streets that penetrate a grid road structure can shorten the routes to a particular destination.

Diagonal streets not only penetrate street blocks, but are also visually appealing. In comparison to straight street structures, diagonal streets can offer pedestrians varied scenery; scenery of interest to pedestrians includes landscape, buildings, facades, road pavement, sidewalk, open space, and shops. The available scenery plays a role in pedestrians' path choices. Also, as noted by Gordon Cullen, it is important in town design to consider the point of view of a moving person (Cullen, 1971). Diagonal streets can offer new perspectives to pedestrians and thus can play a role in attracting them. Environmental arrangements may play an important role when pedestrians choose paths to their destinations (Zacharias, 2001). Furthermore, intersection density has negative effects on pedestrian satisfaction with walking (Kim *et al.*, 2014). Diagonal streets are one means of traveling along a street without crossing. Different street structures offer different amounts of information on the street. Street structures that are suitable in providing information on the physical characteristics of the street will naturally attract pedestrians and vitalize that street.

When pedestrians choose paths, they consider the most suitable path to their destination and paths that they will enjoy walking. Thus, when they do not have specific destinations, they will choose their paths based on visual information they obtain from the street environment. Pedestrian path choice is affected not only by distance to the destination, but

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also by various environmental factors (Guo and Loo, 2013). It is affected by street environment; weather protection, crowds, number of crossings, safety, and noise (Seneviratne and Morrall, 1985), sidewalk width, open space, presence of retail, topography, and street crossings (Guo and Ferreira, 2008; Guo, 2009). However, distance has the greatest effect on path choice (Rodriguez *et al.*, 2014). If people visit new places and have no particular destination, they tend to choose paths with more crowds (Zacharias, 2001). Previous studies on pedestrian path choice have focused on the shortest distance to the destination and environmental characteristics of streets; such environmental characteristics include characteristics of the buildings (uses), pedestrians (volume and activity), and the walking environment (pavement, network, and surrounding environment).

On the other hand, Lee *et al.* (2014) noted that street structure had not been focused on in previous studies, and argued that it was an important factor in pedestrian influx. They investigated the question of whether street structure affects pedestrians' path choice, conducting an experiment using a 3D simulation of street structure to isolate the effects of street structure upon path choice. The results showed that pedestrians tend to choose diagonal streets. The present paper focuses on diagonal streets. Some characteristics of diagonal streets include the angle at which they meet the grid, the width of the street, and the height of the buildings along the road. The main point of the present paper is that the deciding factor in pedestrians' path choice would be the structural characteristics at the start of the intersection, because the diagonal streets have different visibilities according to the intersection angle. The difference in range of sight corresponds to a difference in the amount of information available to pedestrians. It is thought that this will impact pedestrians' path choice. In the field of urban design and planning diagonal street pattern is one of the important elements that give cities more diversity. The street views and acute angle plots vary according to angle of diagonal streets and environmental elements such as trees, sidewalk, land use, and road pavement. These facets attract people's interest when they are walking on streets. If people are interested in walking and they walk more via diagonal streets, it could improve public health, encouraging walking and social community of regions.

However, in the case of grid-patterned streets, generally the streets have same angle and structures, which have small differences in the amount of visual information. Planned cities are generally designed to include perpendicular grid-patterned streets; in such cities, path choice is more likely to be affected by environmental factors, such as building use, building shape and sidewalks, than by street structure.

Accordingly, the present work was conducted assuming that diagonal street structure affects pedestrians' path choices; this assumption was based on the results of the previous 3D simulation experiment (Lee *et al.*, 2014), which controlled participants' destination and was carried out to study street structure excluding other environmental factors. This study demonstrated that pedestrians chose diagonal streets more frequently than straight streets.

This paper aims to further study whether street structures and environmental factors play a role in actual path choices in the real world.

2. Research Design

2.1 Elements of the Street Environment

Choi (2003) classified physical street environmental factors as follows: street trees, signs, wall paintings, street furniture, building use, D:H ratio, skyline, road material, and pedestrian road. Also, Choi and Hyun (2010) used pedestrian road width, road pavement material, building height and color, roofs, green spaces, and street furniture as physical factors in their study. In another study done by Song *et al.* (2014), however, street environmental factors were classified into structural, physical, land use, and locational categories. Structural characteristics included street length and width, road type, road angle, and D:H ratio, and physical characteristics included street furniture, signs, sculpture, street trees, buildings, pedestrian roads, facades, and color. They defined street structural factors to include only the structural environment, excepting the physical environment. Therefore, in this study the street structural factors are defined based on a study of them. Factors that affect pedestrians' path choice at an intersection are the environmental factors that are

Table 1. Variables Considered

Category	Variables		Valid Values		
Street Structural Factors	Angle (deg)		Measured value		
	Width of diagonal street (m)				
	Width of straight street (m)				
Street Environmental Factors	Commercial use		Pedestrian-friendly commerce: 1		Non-pedestrian-friendly commerce and other uses: 0
	Street trees		Yes: 1		No: 0
	Presence of sidewalk on the road		Yes: 1		No: 0
	Road pavement		Paving block: 1		Asphalt: 0
	Use of acute angle plot	Pocket park (base)	0	0	0
		Traffic island	0	1	0
		Building	0	0	1

sensed visually. At an intersection, pedestrians can see the angle, width, and length of the street, buildings' height and uses, road pavement, the presence or absence of sidewalk, street trees, the use of acute angle plots, parked cars, traffic, signs, facades, benches, and open spaces. In this study, environmental factors were carefully selected according to the following standards. First, factors were selected based on the actual street environment at the study sites. Second, they had to be visible by pedestrians at the intersection. Third, variable factors such as parked cars and traffic were excluded. Factors meeting these standards were then classified as either structural or environmental factors.

Factors classified as structural included the width of the street and the angle formed between the straight and diagonal streets; these factors determined the form of the intersection. Environmental factors included commercial use, road pavement, presence of sidewalk on the road, presence of trees, and the use of the angle plot at the intersection with the diagonal street.

Table 1. shows the structural and environmental factors considered in the present study. Various factors were excluded from consideration: highly variable factors such as the presence of parked cars and traffic; any visual information not available at the intersection, such as the presence of open spaces or benches or the height of buildings not visible from the intersection; and factors that are difficult to quantify such as signs and facades. Factors such as the presence of sidewalk, trees, and road pavement were excluded from consideration regarding the straight streets because they were the same at all sites. Commercial use along the straight street was also excluded because pedestrians cannot distinguish different shops and stores from the intersection. Also, the height of buildings was excluded for the following reasons. First, the most visible building height at the intersection is that of the building present in or immediately adjacent to the acute angle plot at the corner. However, this building faces both the straight street and the diagonal street; also, in the present study the straight streets were wide arterial roads. Thus, from the intersection it is difficult to see buildings across the straight streets and buildings behind the corner building.

Each factor was measured as follows. Street widths of both the straight street and the diagonal street were

Table 2. Commerce Classifications

Category	Uses
Pedestrian-friendly commerce (PF)	Cafe, convenience store, restaurant, cosmetics store, clothing store
Not pedestrian-friendly commerce and other uses (NPF)	Dwelling, paper store, light store, tire store, metal store, car retail, bank, office building, real estate agency

Table 3. Structural and Environmental Factors in Diagonal Street

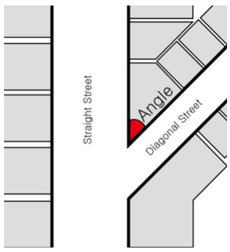
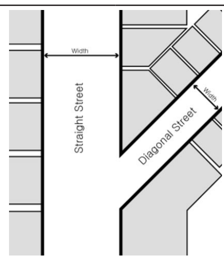
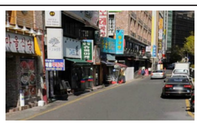
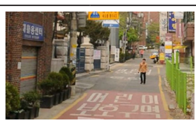
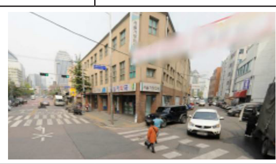
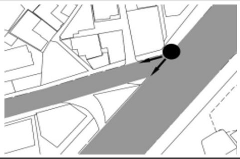
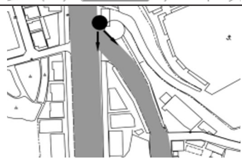
Category	Variables	Example				
Street structural factors	Angle			Widths of straight street and diagonal street		
Street environmental factors	Commercial use			Road pavement		
		Pedestrian-friendly commerce (PF)	Not pedestrian-friendly commerce or other use (NPF)		Paving block	Asphalt
	Sidewalk			Street trees		
		Sidewalk present	No sidewalk/ shared road		Street trees	No street trees
	Use of acute angle plot					
		Traffic island	Pocket park		Building	

Table 4. Sites with Various Uses of the Acute Angle Plot

Category	Street view	Satellite image map	Floor plan	No.	Sites
Traffic island				1	Gwangjang-ro
				2	Saemunan-ro 5ga-gil
				3	Hancheon-ro 10-gil
				4	Hanbit-ro
				5	Dongho-ro 34-gil
Pocket park				6	Dapsimni-ro 15-gil
				7	Dongjak-daero 23-gil
				8	Dohwa-gil
				9	Wangsimni-ro 5-gil
				10	Nakseongdae-ro 3-gil
				11	Myeongdong 9-gil
Building				12	Daehak-ro 3-gil
				13	Hakdong-ro 43-gil
				14	Yulgok-ro 14-gil
				15	Nonhyeon-ro 175-gil
				16	Eulji-ro 35-gil

measured. Street angle was measured at the crossing point of the straight street and the diagonal street. Regarding street environmental factors, commercial use was classified as pedestrian-friendly (PF) and not pedestrian-friendly (NPF); Table 2. lists the classifications used. On the diagonal street, the road pavement type was classified as either paving blocks or asphalt.

We checked for the presence of sidewalk separate from the road and the presence of street trees. The uses of the acute angle plots were classified as pocket parks, traffic islands, or buildings. Table 3. gives examples of each of these measurements and classifications.

2.2 Study Areas

The study sites were selected as follows. First, all sites were located in Seoul. Second, only sites with a floating population as classified by the Seoul Intelligent Urban Information System were selected. Third, only intersections within a 500 m radius of the nearest subway station and with acute angles were selected; these angles were considered from the perspective of a pedestrian coming from the nearest subway station exit. Lastly, according to the research focus on commercial use and encouraging walking, some additional restrictions were applied to site selection. Straight streets were restricted to arterial roads and the diagonal streets were restricted to collector roads which penetrate a street block. In Korea, arterial roads tend to be broad, with many traffic lanes, and are thus not considered pedestrian-friendly. Contrastingly, collector roads tend to be pedestrian-friendly, including commercial uses such as retail shops. For this reason, projects about walking in Korea tend to focus on collector roads.

Based on these standards, we selected study sites by consulting a map of Seoul. Each site was personally investigated by a researcher, who excluded any sites they did not perceive as a diagonal street. Selected sites were divided in three groups according to the use of the acute angle plot; 16 total sites were selected, with 5 or 6 sites for each group.

2.3 Survey on Path Choice

In general, people tend to choose the shortest routes to their destinations. Accordingly, to evaluate other factors affecting path choice, in the present work we asked pedestrians to suppose that they had no destination. We administered a questionnaire including demographic items, items regarding each subject's utilization of streets, and each subject's path choice between the straight street and the diagonal street at the study site. We surveyed 493 pedestrians who were walking on the streets at that time by each of the 16 sites. Surveys were administered during between 10 am and 4 pm over five days in October 2014, when the weather was clear and suitable for walking. Structural and environmental factors were clearly visible on the survey days. Before they started the survey, pedestrians were asked to respond as if they had no specific destination in mind.

Each survey was performed from a viewpoint along the straight street at which a pedestrian would begin to see the diagonal street ahead, near the obtuse corner of the two streets (Fig.2.).

At this point, pedestrians start to think about choosing their path as they approach the intersection. The survey was not done at the intersecting point because at this point, the diagonal street may seem to be straight depending on a pedestrian's point of view. In such a case, there would be no visibility gap arising from the angle between the two streets.

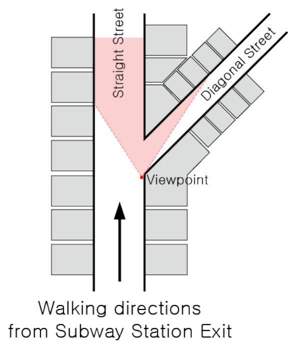


Fig.1. Viewpoint at Intersection

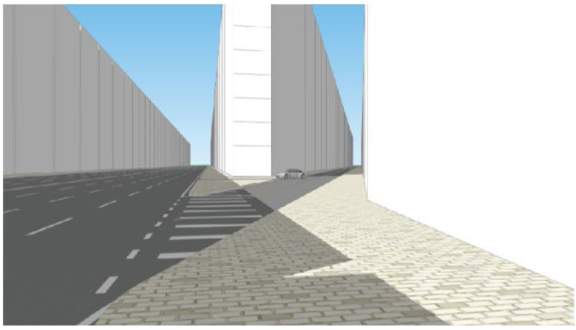


Fig.2. Street View at the Intersection

2.4 Progress of Analysis

The subjects' path choice responses were analyzed to confirm whether pedestrians actually preferred the diagonal streets. Then, the effects of the diagonal street's structure and environment on path choice were examined by means of logistic regression. The dependent variable was the path choice between the straight and diagonal streets. The independent variables were the intersection angle, the street width, the commercial use, the road pavement type, the presence of street trees, and the use of the acute angle plot. Additionally, age and gender variables were added to determine whether these affected the participants' responses.

3. Results

3.1 Measurement of the Diagonal Streets

We measured structural and environmental variables at the 16 diagonal street sites to examine their effects on path choice. Among the 16 sites selected, the smallest intersection angle was 12° and the largest was 66°. The diagonal streets ranged from 7 to 13 m wide; they were not very wide because they were all collector roads. There were six PF streets, such as one including a restaurant and a cafe, and 10 NPF streets including uses such as dwellings and paper, light,

Table 5. Environmental Variables Visible at Each Site

Site	AG	WD	WS	Use of diagonal street: Left side	Use of diagonal street: Right side	CUD	SW	RP	ST	UAP
1	40	11	24	Cafe, internet cafe, convenience store	Cafe, restaurant, cell phone store	PF	Yes	Asphalt	NO	Traffic island
2	32	8	15	Bank, restaurant, cafe	Cafe, convenience store, cosmetics store	PF	Yes	Asphalt	Yes	
3	30	10	17	Apartment, cafe, cell phone store	Repair shop, police substation	NPF	Yes	Asphalt	Yes	
4	32	8	14	Tire store, aquarium, laundry	Metal store, motorcycle sales, motorcycle sales	NPF	Yes	Asphalt	Yes	
5	27	6	16	Paper, convenience store	Cell phone store, hardware store, hardware store	NPF	No	Asphalt	NO	
6	45	7	30	Apartment	Underground parking garage	NPF	No	Asphalt	Yes	Pocket park
7	38	11	37	Parking lot, apartment, green space	Cafe, home appliance store, convenience store	PF	Yes	Asphalt	NO	
8	22	8	35	Cafe	Bank, restaurant, optician	PF	Yes	Paving block	Yes	
9	12	8	22	Community center, police substation, senior citizen center	Restaurant, restaurant, property	NPF	No	Asphalt	Yes	
10	32	9	17	School, green space, church	Church, restaurant	NPF	Yes	Asphalt	Yes	
11	59	13	30	Bank, office building, cafe	Convenience store, restaurant	PF	Yes	Paving block	Yes	
12	53	4.4	20	Bank, recycling center, office building	Cafe, parking lot, clothing store	NPF	No	Asphalt	NO	Building
13	57	5	32	Parking lot	Parking lot, construction site	NPF	No	Asphalt	NO	
14	59	10	18	Pharmacy, hospital, restaurant	Repair shop, restaurant, hardware store	NPF	No	Asphalt	NO	
15	54	8	39	Optician, karaoke, pub	Hospital, clothes store, cafe	PF	No	Asphalt	NO	
16	66	7	26	Paper store, paper store, pharmacy	Paper store, paper store, paper store	NPF	No	Asphalt	NO	

Abbreviations — AG: angle; WS: width of straight street; WD: width of diagonal street; CUD: commercial use in diagonal street; PF: pedestrian friendly commerce; NPF: non-pedestrian friendly commerce; RP: road pavement; SW: sidewalk; ST: street trees; UAP: use of the acute angle plot

Table 6. Participant Demographics

Category		N (%)	Category		N (%)
Gender	Male	305 (61.9%)	Age	10–19	29 (5.9%)
				20–29	243 (49.3%)
	Female	188 (38.1%)		30–39	74 (15.0%)
				40–49	39 (7.9%)
	Total	493 (100%)		≥50	108 (22.0%)
				Total	493 (100%)

and hardware stores. Six of the diagonal streets had sidewalks and 10 did not. Of those 10 streets, two were paved with paving blocks, which encourage cars to slow down. Eight streets had trees planted. Regarding use of the acute angle plot, five streets had buildings, 6 had pocket parks, and five had traffic islands.

Table 7. Frequency of Path Choice

Site	Straight street	Diagonal street	Total
1	7	26	33
2	7	26	33
3	12	21	33
4	15	19	34
5	15	12	27
6	9	24	33
7	17	16	33
8	5	28	33
9	10	23	33
10	14	19	33
11	4	24	28
12	17	11	28
13	24	3	27
14	15	12	27
15	9	19	28
16	12	18	30
Total	192(38.9%)	301(61.1%)	493(100%)

3.2 Major Findings

Of the 493 participants, 61.9% were male and 38.1% were female. Among the age groups, most participants were in their 20s (49.3%) followed by those over 50 (22.0%) and those in their 30s (15.5%). Among the participants, 301 (61.1%) chose the diagonal street and the remaining 192 (38.9%) chose the straight street. At 11 of the 16 sites, people preferred the diagonal street. This result agrees with that of 3D simulations conducted in a previous study (Lee *et al.*, 2014); that study was focused on street structure in isolation from the street environment, whereas the present work included both structural and environmental factors at real sites. These results demonstrate the possibility that diagonal streets provide a more interesting environment for pedestrians. However, it was necessary to further study which factors of diagonal streets affect path choice by using logistic regression modeling.

3.3 Diagonal Street Characteristics with Path Choice

The logistic regression model was used to examine which street characteristics affect path choice. In this analysis, the dependent variable was the path choice, between the straight and the diagonal street, and the independent variables were the street structure and street environment. The goodness of fit of this model was 0.000 ($p < 0.01$) and the Hosmer–Lemenshow goodness of fit was 0.336 ($p > 0.05$); thus, this model was considered to be appropriate.

The result showed the angle, width of diagonal street, commercial use, street tree, road pavement, and use of acute angle plot to be significant factors that have effects on path choice. The intersection angle was shown to have a negative relationship with diagonal street path choice; that is to say, the lower the angle, the more likely pedestrians were to choose a diagonal street. This can be explained by the fact that visibility is increased with lower angle. Higher visibility allows pedestrians to obtain more information about the street before choosing it. However, it is a prerequisite that people can see the facades of buildings. Because the results of angle factor analysis suggest that streets with a 0° angle (i.e., straight streets) are preferred by pedestrians.

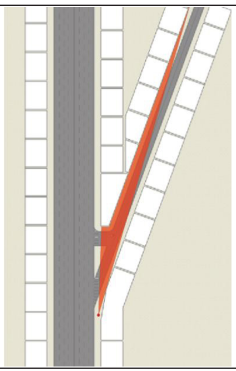
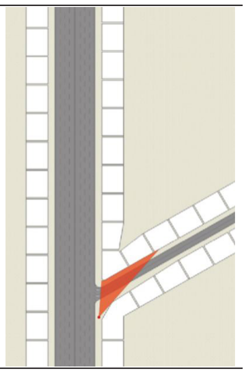
Table 8. Logistic Regression Analysis

Factors	*B*	*p*	Exp(*B*)
Angle (log)	-1.567	0.042**	0.209
Width of diagonal street (log)	2.693	0.007**	14.779
Width of straight street (log)	−0.672	0.469	0.511
Commercial use	0.555	0.068*	1.741
Street tree	0.669	0.070*	1.952
Road pavement	1.262	0.005**	3.534
Use of acute angle plot (pocket park)		0.010**	
Use of acute angle plot (traffic island)	0.939	0.003**	2.557
Use of acute angle plot (building)	1.139	0.049**	3.122
Sex	0.138	0.497	1.148
Age	−0.108	0.107	0.897
Constant	0.330	0.862	1.391

Notes — dependent variable: path choice; * $p < 0.1$; ** $p < 0.05$
Percentage correct on classification table: 65.5%

Pedestrians' preference for wider streets can be explained by the same reason. The width of the diagonal street had a positive relationship with diagonal street path choice. Broader streets are more open and thus have higher visibility compared to narrow streets. Pedestrians receive more visual information more quickly on lower-angle, wider diagonal streets, which may interest them and stimulate their curiosity. Thus, it is quite probable that they would choose such diagonal streets over the straight streets when they choose a path at an intersection. Table 9. shows two isovists that illustrate the differences in visibility of diagonal intersections with different angles. In the 20° case pedestrians are able to see the sixth or seventh building on the diagonal street, however, in the 60° case they can only see two or three buildings because the building on their right at the corner obstructs their view. Thus, lower intersection angle increases the visibility of the diagonal street ahead, allowing pedestrians to see the physical environment of the street, cars, and crowds on that street. A previous study done by Song *et al.* (2014) also found that visibility of building facades is higher at 10° to 30° angles than at 40° to 70° angles, and that people tend to choose diagonal streets with a lower angle. Another reason that pedestrians tend to choose diagonal streets is that street networks would have diversity with diagonal streets. Diagonal streets within a grid pattern are elements that can increase pedestrian interest. When pedestrians come across both the diagonal and straight streets, it is an opportunity to experience a new type of street structure and to have an additional choice aside from straight streets.

Table 9. Visibility According to Intersection Angle

Angle	20°	60°
Visibility		

Pedestrians preferred to choose diagonal streets with commercial use. This result agrees with the results of previous studies that examined the relationship between commercial use and walking (Seneviratne and Morrall, 1985; Guo and Ferreira, 2008; Guo, 2009). Pedestrians were interested in commercial use and this played a role in path choice. Guo and Loo (2013) showed that open space and retail frontage affect path choice. This finding was similar in that it dealt with visual impact in the same context. The road pavement type played a role in path choice when pedestrians chose diagonal streets over straight streets. This is related to pedestrians' perception of safety, because paving blocks encourage cars to drive more slowly. This environmental factor makes pedestrians feel safer and also improves the street aesthetically. These results support the results of previous studies that safety and sidewalk factors affect path choice (Agrawal *et al.*, 2008; Brown *et al.*, 2007; Guo and Ferreira, 2008; Guo 2009; Guo and Loo, 2013). Pedestrians are also more likely to choose a diagonal street when there are trees planted on the street. Trees beautify the street and also can be viewed as a boundary between the road and the sidewalk, making pedestrians feel safer.

Pedestrians are more likely to choose a diagonal street when the acute angle plot located at the beginning of the intersection is a building or a traffic island, rather than a pocket park. Traffic islands discourage pedestrians from continuing on the straight street because doing so requires crossing two crosswalks. Instead, they will prefer to switch to the diagonal street to avoid crossings. Also, when there is a building in the acute angle plot, which is the most visible place from the intersection, pedestrians may be interested in stores in the building and may choose the diagonal street for that reason. The present results conflict with those of the previous study using 3D simulation, which found that pedestrians prefer diagonal streets when there is a pocket park (Lee *et al.*, 2014). This can be explained by the fact that the 3D simulation did not reflect the scale of the street or environmental factors other than street structure.

4. Conclusions

Walking is both a basic physical activity and a means of transportation. People generally prefer the shortest route to their destination. Along the way to a destination they are faced with many intersections, and at each one they have to choose a street. Various factors affect pedestrians' choices when making such decisions. The aim of the present study was to determine which characteristics of diagonal streets affect path choice. This study is distinct from other studies that focused only on environmental factors, excluding streets' structural factors. The results of the questionnaire suggested that many pedestrians choose diagonal streets more than straight streets when they do not have a destination. The factors found to affect path choice were the intersection angle, width of the diagonal street, commercial uses, road pavement type, and presence of street trees. Diagonal streets with commercial uses could attract pedestrian interest in shopping compared to those with non-commercial uses. The angle and width of streets affect the visibility of the diagonal street ahead; when it is more visible, pedestrians gain more information about the street and this affects their path choice. The road pavement type and presence of street trees affects path choice because they make the street safer and are aesthetically pleasing. Traffic islands or buildings in the acute angle plot also affected path choice by providing more information and increasing the convenience of switching off the straight street.

Previous studies found many environmental factors that affect path choice. Factors related to sidewalks, shops, human activity, streets, crosswalks, traffic, and topography are all important to consider in the issue of path choice. In the same context, we were able to find that factors such as commercial use, presence of street trees, and road pavement type affected path choice in the present study. These factors can be applied in new or existing locations. However, the effects of intersection angle and street width upon visibility cannot be manipulated easily. For this reason, such factors are considered to be important when designing streets. We would like to emphasize that one of the strengths of diagonal streets is that they can provide varying views and information from different viewpoints, unlike grid-patterned streets, which have limited views.

Overall, wide diagonal streets with high visibility from their intersections will increase pedestrian traffic. In addition, a synergistic effect can be expected when the diagonal street also provides an opportunity to shop in safe and clean environments. The present work is distinct from previous studies that focused on environmental factors only; herein we also examined the effects that structural characteristics of diagonal streets can have in attracting pedestrians. The results of this study suggest that street structures should be considered when selecting sites for pedestrian-related efforts such as street environmental improvement projects, projects to encourage walking, and commercial street improvement projects.

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