

Measuring walkability in Istanbul Galata Region

Özlem ÖZER¹, Ayşe Sema KUBAT²

¹ ozlem.ozler@okan.edu.tr • Department of Architecture, Faculty of Engineering and Architecture, Okan University, Istanbul, Turkey

² kubat@itu.edu.tr • Department of Urban and Regional Planning, Faculty of Architecture, Istanbul Technical University, Istanbul, Turkey

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Abstract

Pedestrian movement is one of the critical issues in urban design, but yet a determinate method for evaluating the attractiveness of an area for walkability has not been established. This paper presents the findings of a comprehensive study on walkability, developed on a historical centre of Istanbul, named Galata that has become segregated in recent years.

This study has researched the possible effects of the environmental variables on the levels of activity in urban spaces. The aim is to shed light on key variables that affect the attractiveness of an area for pedestrian movement, which in turn can help to develop an objective methodology to evaluate walkability. Within the context of the study, the existing pedestrian movement patterns in Galata have been observed and a range of variables have been determined to analyze the relationships.

The data recorded in this study have been analyzed with a multiple regression analysis, in which pedestrian movement levels are considered as the dependent variable. The result of the regression analyses has generated a model that accounts for 0,60 of the variation in pedestrian movement. According to the findings of the model, pedestrian movement levels have been explained with three out of five variables: safety, accessibility (space syntax integration values) and land use pattern. The method and the findings of this study constitute an analytical model that could shed fresh light for future research on walkability as well as for evaluating proposals to regenerate historical city centers that have lost their vitality.

Keywords

Walkability, Pedestrian movement, Physical environment, Spatial analysis.

1. Introduction

Most cities have been facing problems as a result of rapid urbanization and these problems cause social and physical decay in city structures. If the projects developed to prevent this decay focus on beautification, then the positive effects they are expected to bring will be temporary. In order to ensure the rehabilitation of decay areas, land use patterns, spatial potentials and pedestrian preferences should be considered alongside the socio-economical analyses.

Many research are being developed in order to explain the relation between pedestrian movement and space and to define the factors affecting movement patterns.

On the evidence of this research it is aimed to evolve policies on the design of pedestrian roads and on their position in the whole transportation system.

This paper presents a research on pedestrian activity in urban areas, within the concept of “walkability”, in order to establish an analytical basis for future research and developments. Walkability is an expression of the quality of the space (Bradshaw, 1993). Factors that have been considered in previous studies that have developed a “walkability index” can be listed under four main headings those are human factor, physical environment factor, natural environment factor and time factor (Bradshaw, 1993; Stonor et. al., 2001; Teknomo et. al., 2000; Chiaradia et. al., 2005).

Istanbul’s historical Galata region that is located on the intersection of the Golden Horn and the Bosphorus is the case area of this study (Figure 1). Although Galata is located near central areas, it is disconnected from these centres and thus it cannot benefit from the liveliness of them. Many projects have been developed in order to bring vitality to Galata region. The aim is to develop a walkability study to evaluate the physical environment in terms of its effects on pedestrian movement. The outcomes of this study are supposed to serve to estimate the possible effects of design proposals on the activity patterns.

The developed walkability study has

considered 3 main data types:

- Pedestrian movement analyses
- Spatial accessibility - Space syntax integration values
- Physical environment
- Land Use
- Gradient
- Safety and security
- Visual quality, attraction and comfort

The next step of the analyses was to apply multi-regression analyses for the overall data, in which the pedestrian movement levels would be taken as the dependent variable. The multi-regression analyses would help to understand the accessibility, land use, gradient, safety and quality dependence of pedestrian movement patterns, individually.

2. Analyses

2.1. Pedestrian movement analyses

The first step of the analyses was to survey the pedestrian activity in Galata in order to understand existing movement patterns. Pedestrian movement levels have been recorded at 55 locations that were designated to include all the entrances to the study area. The observations were carried out on Sunday September 18, and Tuesday September 20, 2005. Each street segment was observed for five minutes in two-hour time periods, from 08:00 to 20:00, and pedestrians moving in both directions were recorded separately. The weather was cold but not rainy on both

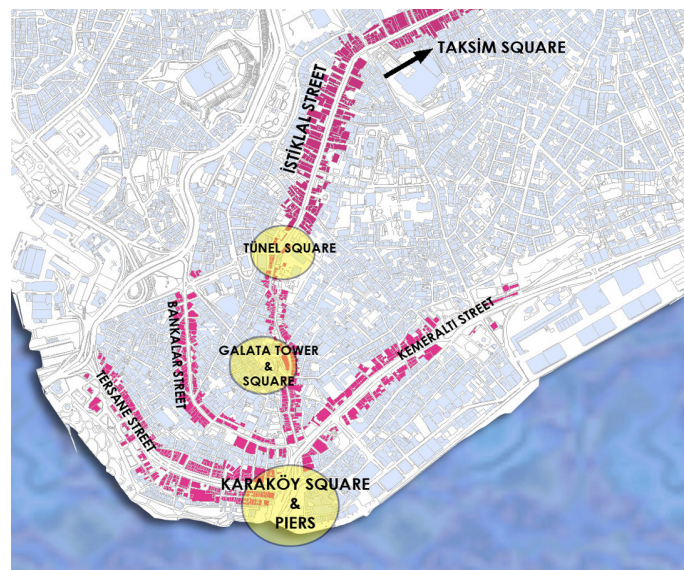


Figure 1. The study area - Galata.

days. Pedestrian movement levels were recorded separately for men, women, elderly, teenagers and children. The results of the pedestrian movement analyses have been compared with several factors in evaluation (Figure 2).

2.1.1. Findings

During the weekday 540.000 and during the weekend 450.000 pedestrians were recorded within the study area. The densest pedestrian activity was recorded on the Tünel Square, which is the border between İstiklal Street and Galata. On the weekday 33.000, and on the weekend 48.000 pedestrians were recorded at the İstiklal Street entrance. On Galip Dede and Yüksek Kaldırım Street, which constitute the continuance of İstiklal Street, the observed movement levels are considerably lower than the levels on İstiklal Street. Still, because these streets attract a “through movement” generated between İstiklal Street and Karaköy Square, the two

central nodes, the movement levels are relatively higher than the inner parts of the study area. The recorded movement levels on Karaköy Square and in front of the piers nearby rank after the levels on İstiklal Street. On this area, the total number of pedestrians recorded during the weekday is 25.000, about a 1/20 of the movement levels on İstiklal Street.

The different categories of people observed in Galata (men, women, elderly, teenagers and children) have a similar pattern in distribution of movement. However, there is a significant difference between their volumes of movement.

For weekday, the dominant user group in the study area is men for all time periods. The movement rate of men is 223 people per hour (pph), while the movement rate of teenagers, which has the second highest movement rates, is 104 pph (Table 1).

The other three user groups have

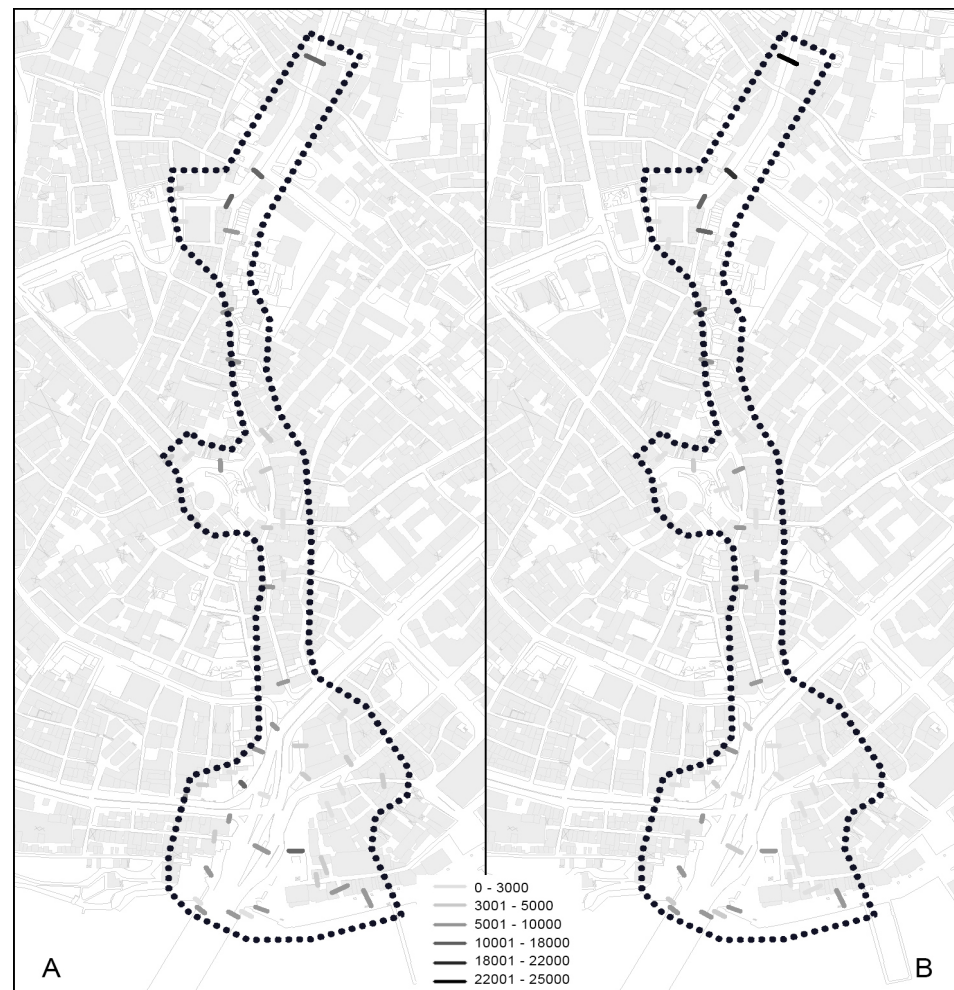


Figure 2. Pedestrian movement rates (A= weekday, B= weekend).

Table 1. Average movement rates.

Average		Weekday (pph)	Weekend (pph)
Direction 1	Men	237	135
	Women	57	50
	Elderly	17	8
	Teenagers	113	167
	Children	9	21
Direction 2	Men	208	122
	Women	51	39
	Elderly	14	8
	Teenagers	96	161
	Children	13	22

very low values compared to men and teenagers. The order of movement levels of these groups are women, elderly and children. The movement levels of weekday and weekend do not show a great difference. However, when the levels are analyzed in categories, a significant decrease in men's movement levels on weekend is observed (Figure 3, 4). The dominant category on the weekend is teenagers throughout the day, but the weekend movement rates of teenagers are less than the weekday movement rates of men.

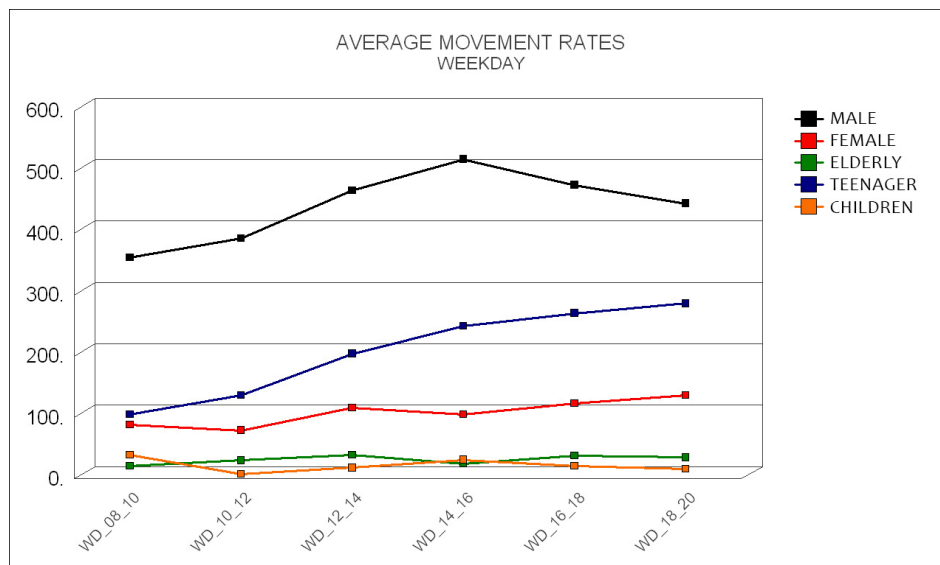
There is a general decrease in the total movement levels in weekend. This can be explained with the quantity of the hardware sellers, electricians and lighting accessories stores, which serve on weekdays and mostly attract men. This is one of the reasons of low move-

ment levels of women and in order to attract a balanced user profile, these land uses should be removed. There is another important fact that, since these land uses require large spaces for storage, they are posing a threat to the historical character of the buildings.

2.2. Spatial accessibility

For the assessment of spatial accessibility, Space Syntax Method has been used. Space Syntax, analyzes spaces by their configuration and calculates "integration values" for all the accessible space in an urban area or building (Hillier and Hanson, 1984; Hillier et. al., 1996; Kubat et. al., 2003). Space Syntax is used as an "instrument" in urban design.

The spatial model of the study area has been prepared and axial map has

**Figure 3.** Average pedestrian movement rates in categories (weekday).

been analyzed for integration. In the walkability study, the integration values of the axial lines in which observation points are located are accepted as the spatial accessibility values (Figure 5).

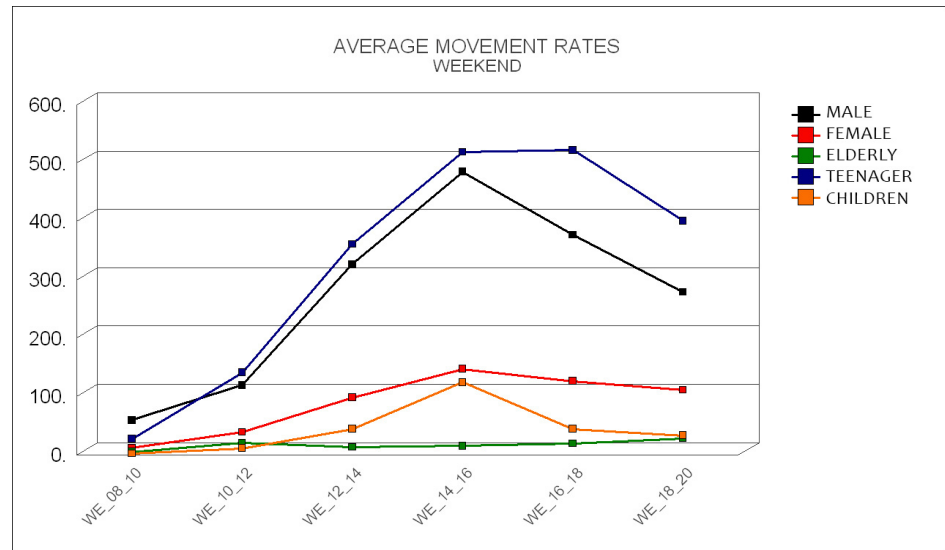


Figure 4. Average pedestrian movement rates in categories (weekend).



Figure 5. Spatial integration analyses of Galata and Taksim.

Both global and local spatial integration analyses have been conducted in order to understand the structure of the entire system and also to see if the relatively segregated parts have an integrated form within closer environment.

The software for Space Syntax analyses calculates the spatial integration values by first selecting a line from the axial map and then calculating how many other lines are required for accessing each line in the whole axial map. The lines with higher integration values have higher accessibility than the other lines. The integration cores of the systems are suitable for central activity by the reason of having an integrated structure.

The spatial integration analyses of Galata have shown that, Bankalar and Kemeraltı streets have the highest integration values. The integration core is the intersection of Karaköy Square and Bankalar Street. However, since Taksim was not included in the analyses, İstiklal Street is on the edge of the axial map and has relatively low integration values.

The spatial model of a larger area, including Taksim, has been prepared and processed. Both local and global spatial analyses of this area have shown the dominant structure of İstiklal Street. Taking the pedestrian movement patterns into account, it is seen that the spatial integration analyses of this larger area display more consistent results. Therefore, the spatial integration analyses of Galata and Taksim area have been used in the research.

The linear integration core of the area continues along İstiklal Street from Taksim Square to Tunnel Square at the end of the street. The predominance of İstiklal Street also increases the integration values of the connected lines. The effect of the integration core is weakened through Galata and thus the analyses explain the deterioration of Galata in spatial context.

2.3. Data on physical environment

In this section, the assessment system which is created to evaluate the pedestrian activity pattern in comparison with the physical factors and the gathered data are explained.

2.3.1. Land use

It is a fact that land use pattern has a remarkable effect on pedestrian movement. In order to examine this relation, a quantitative survey of land use has been carried out.

Galata has a variety of uses observed in specific regions, such as residents, offices, electricians and music stores on and around Hendek Street; hardware sellers on Tersane Street and lighting accessories sellers between Hendek and Tersane streets. İstiklal Street has mostly music stores and music studios, while there are banks and electricians on Bankalar (Banks) Street. In recent years, uses related to tourism industry have started to run around Galata Tower, certainly with the effect of the tower.

The main function observed in the area is commerce, which has a men-oriented structure with the dominance of hardware sellers, electricians and lighting accessories sellers.

The land use pattern of the area builds up a picture in which the south part captures attention as being the commercial district. Moreover, the pedestrian movement analyses show that, the movement observed on this direction has relatively higher values than the opposite direction, which can also be because of the effect of gradient ratio.

In this study, for the calculation of land use values, the number of commercial and service buildings has been counted on the two faces of the axial line which the observation point is located.

2.3.2. Gradient

It is generally accepted that the pedestrians prefer roads with a gentle slope or downgrade ways. The declivitous structure of Galata has brought on the necessity of taking the gradient factor into consideration. Gradient is calculated through the actual elevation values on the base map.

The study area has a downgrade towards the south. There is 60m of elevation between the north and the south borders of the area covered in approximately 600m distance, which introduces an average slope ratio of 10% (Figure 6).

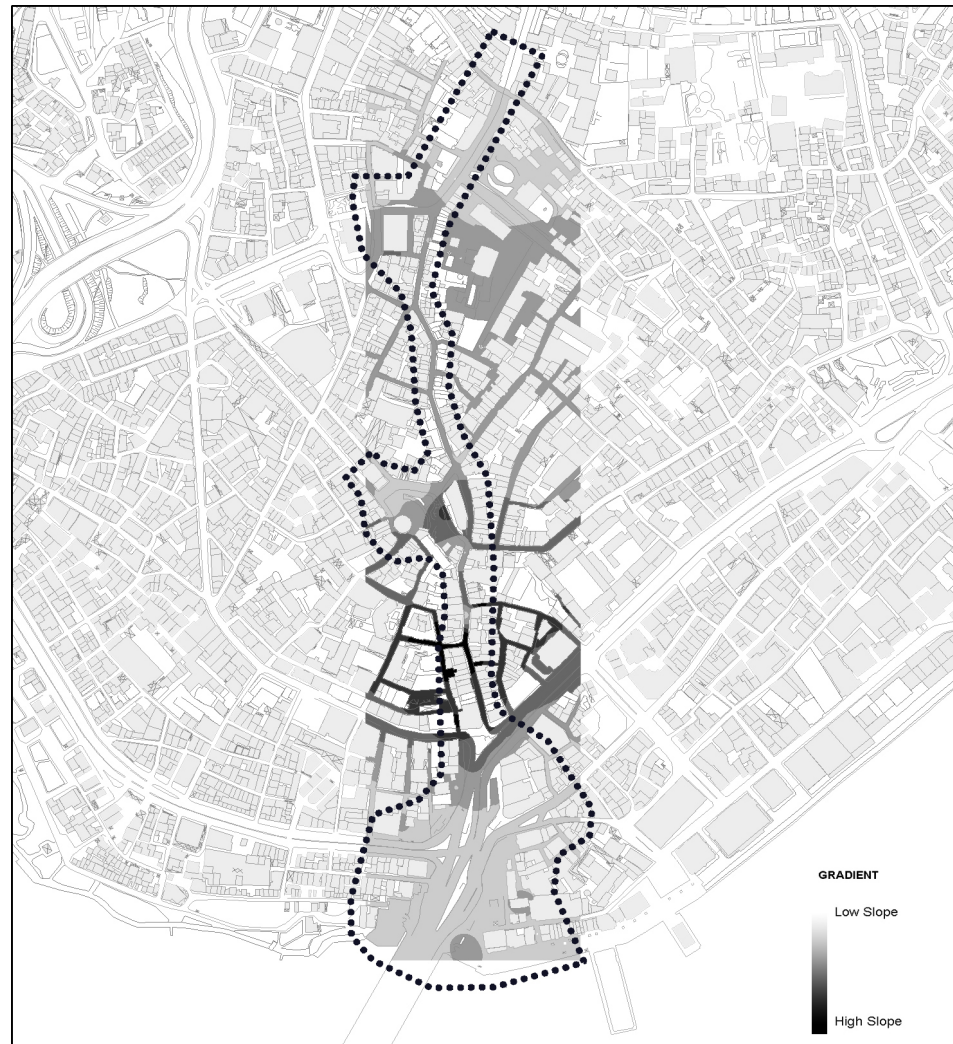


Figure 6. Gradient values of the study area.

2.3.3. Safety and security

Today, safety is one of the most significant factors in urban design. In the present research, this factor is considered under two main headings; traffic safety and security.

2.3.3.1. Traffic safety

In urban design projects, pedestrianizing is one of the most frequent procedures to provide more comfortable spaces for pedestrians and thus increasing pedestrian movement levels. However, pedestrianizing may be inessential in some cases or may not be sufficient since the pedestrianized way has to integrate with the existing pedestrian network.

Moreover, pedestrianizing a road means rearranging the existing traffic flow, and thus it should be determined before putting the decision into practice, to what degree the existing pedes-

trian movement patterns are affected from proximity to road traffic.

In order to determine the levels of traffic safety, the pedestrian-vehicle segregation, traffic density, sidewalk widths and pedestrian crossings have been examined within the context of the study.

In most parts of the study area, density of the vehicle traffic is not so high to restrain the pedestrian activity. The Galip Dede and Yüksek Kaldırım streets continuing along the study area and the connected streets act like semi-pedestrianized ways with a vehicle density less than 100 cars per hour (Kubat et al, 2003). Within the context of the study, all the roads except Hendek, Bankalar, Tersane, Kemeraltı, Necatibey streets and Karaköy Square are considered as partially pedestrian ways.

The wide platform it offers to us-

ers and also having no vehicle traffic, make İstiklal Street gain the highest traffic safety values. The Karaköy Pier and surrounding areas have high traffic safety values because of similar reasons. Karaköy Square has also been defined with high values even though it has a dense traffic flow. This can be explained with the presence of the barriers separating vehicles and pedestrians, and the pedestrian underpass, therefore, offering relatively safer facilities. Galip Dede and Yüksek Kaldırım streets display average levels of traffic safety.

2.3.3.2. Security

The perceived danger is not always as much as the rates of reported crime. In some “statistically dangerous” places, people feel safer than they do in places that are reported as “safe”. Usually people feel safe if there are other people, i.e. if there is a crowd. In fact, some types of crime need to occur within a crowd, such as pick-pocketing. However, these types of crimes do not cause people to be afraid, yet the fear of possible crime one could face in a deserted area could be much more, as it would possibly be more dangerous.

Fear, can be reduced by spatial design. Some environments are perceived as “safe” while some as “dangerous”. Dark subways, long alleyways, deserted areas, poorly-lit streets, empty parks and dense woodland can be some examples for the places that create fear. People, especially when alone, usually

change their ways instead of passing through this kind of places, in order to avoid being exposed to crime (Hutchings, 1994).

Urban design carries weight with its ability to obviate the fear of crime. Fear is, to some extent, a response to the physical elements of space. Usually, presence of other people around reduces this fear. Many people feel stressful, for example when walking through dense woodland, because there are lots of hiding places for potential attackers.

The patterns that “fear of crime” and “statistical crime” rates generate, may display a key to find out their relation with the pedestrian activity patterns.

Crime statistics

The crime statistics per each street for the year 2005 is obtained from Istanbul Beyoglu District Police Department (Table 2). The overall number of crime records of the street, on which the observation point is located, is taken as the crime values in the study.

According to the Beyoglu Police Department records, the highest crime rates are observed on Karaköy Square. Galip Dede and Bankalar streets are on the next rank in crime rates. However, Galip Dede Street seems to be the most dangerous area, since the most dangerous crime type “grab” is observed on this street.

Within the context of the study, the crime rates have been evaluated in total value, without taking the types of crime into consideration.

Table 2. *Crime statistics for Galata, 2005.*

2005	Tophane	Galata Tower	Yuksekkaldirim	Tersane St.	Buyukhendek St.	Karakoy Square	Bankalar St.	Galip Dede St.
Snatching	0	3	0	0	0	2	0	6
Pocket Pick	1	1	0	3	0	8	2	3
Grab	0	0	0	0	0	0	0	3
Theft	0	2	0	1	0	10	6	2
Theft from car	1	0	2	0	2	0	2	0
Total	2	6	2	4	2	20	10	14

Feeling of safety

There are two ways to measure the feeling of safety: 1. Survey, 2. Evaluation of physical environment in means of safety.

In this study, effects of the physical environment on feeling of safety are researched by analyzing several factors.

Access control; is one of the factors that make people think they are in a safe place where not everyone can enter. This factor wasn't included in the study; since there isn't any access control at any point in Galata, every observed location would get the same value.

Long Sight Lines; with the presence of signs, would help in orientation and thus make people feel safer. The presence of long sight lines (300-350m) have been observed and evaluated.

Hiding Places; would certainly make a negative effect on feeling of safety. Potential hiding places have been ob-

served and evaluated.

Street Lighting; is one of the key factors in the feeling of safety. Especially when it gets dark, poorly-lit areas become deserted, while activity goes on in well-lit areas. The lighting facilities on observation points are observed and evaluated.

Presence of patrolmen and patrol cars; is another strong determinant in perception of safety. In Galata there is no specific place that the policemen usually watch, so this factor is not included in the analyses since every point would get the same value.

Activity and liveliness of the environment; would be affected by the presence of active frontages and also other people. Thus, these factors have separately been taken into consideration in the research.

Maintained and owned places usually make people feel safe. In this study, maintenance and being owned have

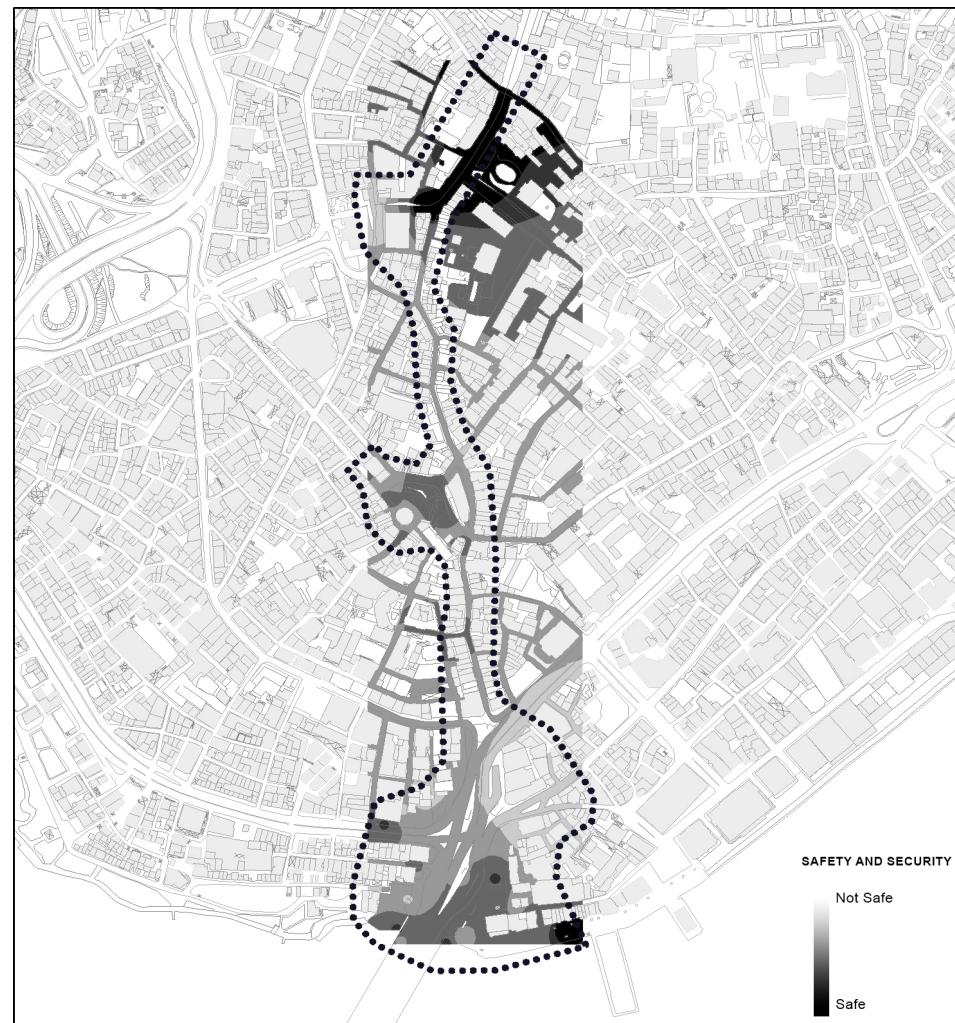


Figure 7. Safety and security values.

been analyzed through visual impression observed with various factors like a chair in front of a store or a flower pot in front of a window.

The determined values for traffic safety, crime rates and feeling of safety analyses have been taken as a total count. According to these total values, the safest locations within the study area are the Tunel Square (at the border between İstiklal Street and Galata) and the front of the pier (Figure 7).

2.3.4. Visual quality, attraction and comfort

In order to understand the effects of visual quality, attraction and comfort on levels of activity, a range of factors have been observed and recorded.

Landmarks: According to Lynch, one of the five elements that define the legibility of cities is landmarks. Landmarks are physical elements that display a unique character and are thus easily-remembered (Lynch, 1960).

The Galata Tower, the Galata Bridge, Karaköy Pier and the Golden Horn are strong landmarks not only for Galata but also for a wider area. Within the context of the study, for each observation point it is recorded if these landmarks are present and perceivable.

Width of the sidewalk: The width of the sidewalks is a significant factor both for traffic safety and for the comfort it offers to users. Especially on the roads that have a high movement density, narrow sidewalks confine the pedestrians and interrupt movement. The sidewalk widths have been recorded for each observation point.

Material of the sidewalk: The materials of the sidewalks have been determined and evaluated by means of their effects to levels of comfort.

Work quality of the sidewalk: The work quality of the sidewalks is a significant factor affecting the levels of activity as well as the width. The users may have trouble even while walking on a path paved with qualified material if the work is cheap. Thus, the work quality of the sidewalks have been marked and evaluated.

Permanent obstructions on the sidewalk: Presence of poles, guardrails, signs, and stairs would prevent the effective use of sidewalks. These factors

have been recorded for each observation point.

The similarity of building designs: The historical character of Galata displays a consistent view, but there are also some buildings that are out of harmony. The similarity of the building types has been taken as a positive factor enhancing visual quality.

Imageability: Imageability is the character of a place that makes it distinct and memorable. If a place has specific physical elements that draw attention, then that place has high imageability (Reid et al, 2005).

Parks, squares and major landscape features and the ratio of historical buildings have been recorded and the levels of active fronts have been counted in calculating the imageability values for each observation point.

Enclosure: Enclosure is the measure of how well streets and other spaces are visually defined by buildings, walls or trees (Reid et al, 2005). The evaluation of spatial enclosure has taken long lines of sight, estimated proportion of street walls and estimated proportion of view to sky.

Human scale: Human scale can be measured by comparing the size of physical elements and the size of humans. Building details, pavement texture, street trees, and street furniture are all physical elements that match the size of humans, thus contribute to human scale (Reid et al, 2005). Presence of long sight lines, the estimated window/wall proportions and number of street furniture have been recorded in measuring human scale.

Transparency: Transparency is related with the perception of the activity beyond the borders such as walls, windows, trees or doors (Reid et al, 2005). Transparency has been observed through these indicators.

Complexity: The complexity of a place which can also be defined as richness is the amount of diverse features of the physical environment (Reid et al, 2005).

In addition to the above factors, maintenance, kerb height, street lighting, noise level, inappropriate car parking have also been observed and recorded.

According to the results, Tunel

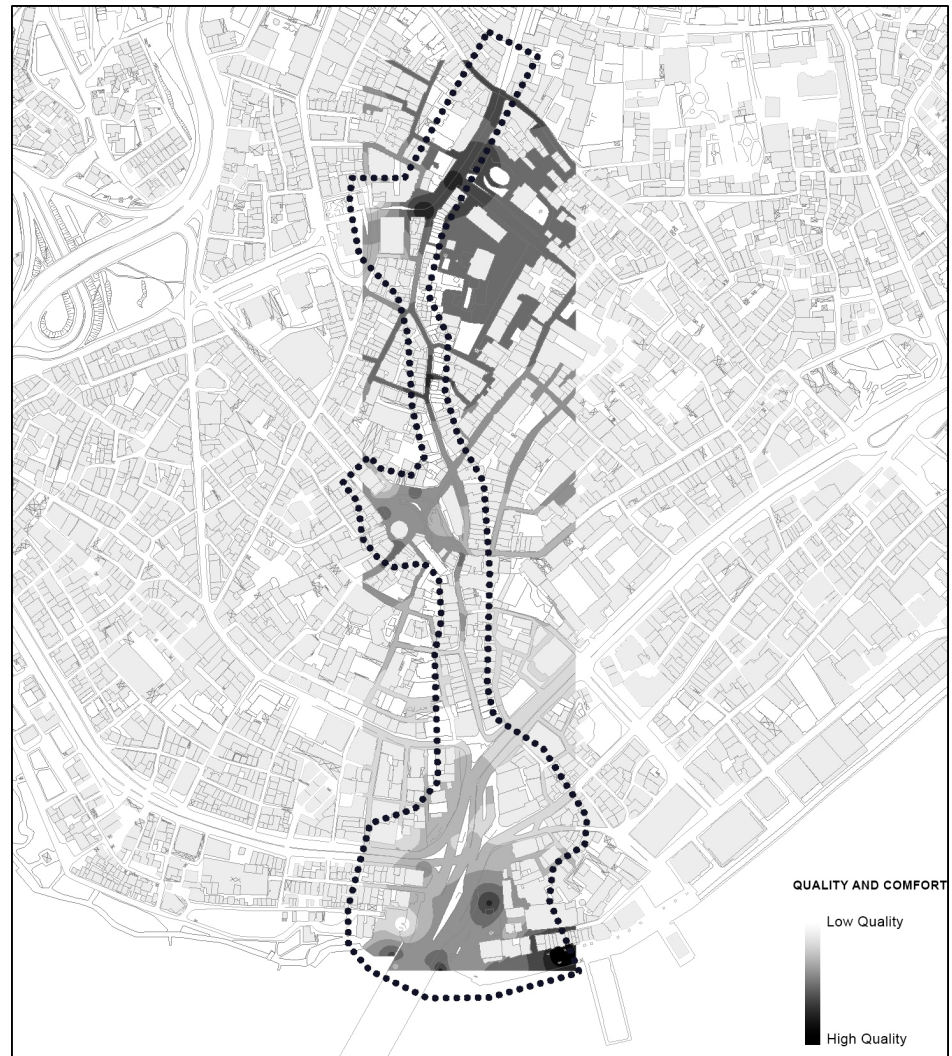


Figure 8. Visual quality, attraction and comfort values.

Square, Galata Tower, Karaköy Square, pier and Galata Bridge get the highest values for visual quality, attraction and comfort (Figure 8).

3. Results of the analyses

The dataset that includes all the observations of pedestrian counts for weekday and weekend, land use analyses, integration values of Space Syntax analyses, gradient ratio, safety and security values and visual quality, attraction and comfort values has been analyzed with a multiple regression analysis, in which the pedestrian movement levels are considered as the

dependent variable, in order to understand to what degree pedestrian movement levels are affected by what type of environmental factors.

The multi-regression analyses have been carried out for all the different categories of users (male, female, elderly, teenagers and children) and for both weekday and weekend activity levels separately.

The model that explains the pedestrian movement levels with the highest accuracy has been generated with the total pedestrian levels of weekend. This model accounts for 60% of the variation in pedestrian movement (adjusted

Table 3. Model summary.

Model	R	R Square	Adjusted R Square	Std. Error
1	0,793	0,630	0,608	1669,545

$r^2=0,60$) (Table 3).

Since the model has taken the weekday movement levels, the dominant levels of “men” which is caused by the obligation of men to use the area for professional purposes does not affect the results, thus the model enables us to evaluate the activity levels for entertainment, leisure, catering and retail.

According to the model, the pedestrian movement levels are defined by the safety and security, space syntax integration values and land use variables (Table 4).

The “beta” value refers to the ratio that pedestrian movement levels will be affected by a change of “1 unit” in any of the variables, while the other two variables are constant. For instance, if safety value increases 1 unit, while the land use and integration values are constant, the pedestrian movement levels are estimated to increase 46%.

The model shows that, the variable that affects the pedestrian activities the most is “safety and security”. Accordingly it can be said that, pedestrians pay attention to the potential threat that can be generated by vehicles or other people, while deciding which route to choose.

According to the model, one of the reasons of low levels of activity in Galata is the lack of accessibility that is shaped by the spatial configuration. As mentioned before, Galata has a potential to attract “through movement” by the reason of its location near to active and alive centres. However, it cannot benefit from this potential because of its spatial configuration. The results of the multi-regression analyses support the idea that spatial integration values are determinant on movement levels.

According to the model, the third

factor affecting the activity levels is land use. The central location of the study area gains strength with the central uses such as retail and service. As explained in the theory of the “movement economy”, the axial lines those have a movement potential are supposed to attract movement which in return will attract movement-seeking land uses and thus the correlation between the movement levels and spatial configuration has a tendency to increase (Hillier, 1996). The areas that do not have central uses, for instance residential areas, are not expected to attract a great amount of movement, even if they are highly secure and accessible.

The multi-regression analyses explain the pedestrian movements with these three out of five variables. The model does not include “visual quality, attraction and comfort” and “gradient”.

A correlation analysis has been applied to the visual quality, attraction and comfort dependence of pedestrian movement levels. The highest values have been achieved from the correlation of female and elderly people with visual quality, attraction and comfort (female=0,61; elderly=0,58). Since the activity of these two user groups are mostly for visiting purposes, it can be concluded that people may care about the quality issue if they do not have to use the area for an obligatory purpose or if they do not have a limited time. Accordingly, the visual quality, attraction and comfort can be said to have an added attraction effect on pedestrian activity.

Gradient has been found significant neither in the multi-regression analysis, nor in the correlation analysis. This insignificance might be explained with the presence of a subway, known as

Table 4. Coefficients.

Model	Standardized Coefficients		t	Sig.
		Beta		
	(Constant)			
1	Safety		- 6,082	,000
	Integration Values	,462	4,971	,000
	Land Use	,316	3,382	,001
		,278	2,958	,005

“Tünel”, between the mentioned two central nodes, Karaköy Square and İstiklal Street. Since many people use this subway, probably most of the people were recorded during a short-distance movement in the observations, and they would have preferred to use the subway if they had aimed to cover the whole distance.

4. Conclusions

This research examines the existing pedestrian movement patterns of the historical Galata region with the aim of establishing an analytical basis to estimate possible effects of development proposals on the activity patterns.

The results of the analyses have demonstrated that, central functions such as retail and services should be supported in order to enhance the movement potential of Galata and vivify the area, which in return will again attract such uses. The remarkable effect of safety and security on pedestrian activity levels is a result of the remote station of Galata. The multi-regression analyses have clearly shown the effect of spatial configuration, which is quantified with Space Syntax method, on pedestrian movement patterns, thus emphasizing the use of Space Syntax as a tool in urban design.

It is recommended to make benefit from these outcomes in future projects, as considering accessibility, introducing attractive functions to sustain the central character of Galata and bearing in mind that the safety and security issue is the most important problem of the area and the most significant factor affecting the pedestrian activity levels.

The method and the findings of this study are believed to contribute to future research on walkability as well as for evaluating proposals to regenerate historical city centers that have lost their vitality.

References

Bradshaw, C. (1993, October). *Creating and Using a Rating System for Neighborhood Walkability: Towards an*

Agenda for Local Heroes. Paper presented at the 14th International Pedestrian Conference, Boulder, Colorado.

Chiaradia, A., Rafor, N., & Takamatsu, S. (2005, June), *The Walkability Index: Through a Structured Framework*. Poster session presented at the 5th International Space Syntax Symposium, TU Delft, Delft.

Hillier, B., & Hanson, J. (1984). *The Social Logic of Space*. Cambridge: Cambridge University Press.

Hillier, B., Penn, A., & Dalton, N. (1992). Milton Keynes: Look Back to London. *The Architects' Journal*, 195, 42-46.

Hutchings, C. (1994). Creating Fear by Design. *Geographical Magazine*, 66, 8-32.

İstanbul Beyoğlu District Police Department, (2005). Crime Statistics, İstanbul.

Kubat, A. S., Eyüboğlu, E., Ertekin, Ö., Özer, Ö. (2003). *Application of Space Syntax in Regeneration and Transformation of Galata and Büyük Hendek Street* (final report). İstanbul: Urbanism Atelier of Greater Municipality of İstanbul.

Lynch, K. (1960). *The Image of the City*. Cambridge: The MIT Press.

Özer, Ö. (2006). *Yaya Hareketleri ve Mekan İlişkisi: İstanbul Galata Bölgesi Örneği, Yüksek Lisans Tezi, Disiplinlerarası Kentsel Tasarım Programı, İTÜ Fen Bilimleri Enstitüsü*.

Reid, E., Clemente, O., Handy, S., Brownson, R., & Winston, E. (2005). *Identifying and Measuring Urban Design Qualities Related to Walkability (final report)*. Princeton, NJ: Robert Wood Johnson Foundation.

Stonor, T., Arruda Campos, M. B., & Smith, A. (2002, May), *Towards a Walkability Index*. Walk 21, Third International Conference, San Sabastian, Spain.

Teknomo, K., Takeyama, Y., & Inamura, H. (2000). Data Collection Method for Pedestrian Movement. *Dimensi Teknik Sipil – Journal of Civil Engineering Science and Technology*, 2, 43-48.

İstanbul Galata'da yürünebilirliğin ölçülmesi

Hızlı ve kontrolsüz şehirleşme, yönetim birimlerini ve planıcıları, yaşamı insanlar için kolaylaştırma yollarını aramaya yöneltmiştir. Şehir yaşamı giderek hızlanmakta ve bu dinamizm içinde şehirselleşme, sosyal ve fiziki anlamda zarar görmektedir. Çöküş sadece fiziksel anlamda ele alınır ve güzelleştirme projeleriyle bu durum düzeltilmeye çalışılırsa yapılan müdahale geçici bir etkiye sahip olacaktır. Alanların kullanımını istenen düzeye getirmek için yapılacak düzenlemelerde, sosyo-ekonomik analizlerin yanı sıra arazi kullanımları ve yaya eğilimleri göz önünde bulundurulmalıdır.

Bu çalışmada, kentsel tasarım ve planlama uygulamalarında bu gereksinime cevap vermek amacıyla kentsel mekanda yaya hareketleri, "yürünebilirlik" kavramı çerçevesinde incelenmektedir. Çalışmada, İstanbul Boğazı'nın Haliç ile kesişiminde yer alan tarihi Galata bölgesi incelenmek üzere seçilmiştir. Galata oldukça merkezi bir konuma sahip olmasına rağmen şehrin diğer kısımlarından kopuk kalmıştır. Galata'ya eski canlılığını tekrar kazandırmak ve şehir ile bütünleşmesini sağlamak amacıyla projeler geliştirilmektedir. Bu çalışmada amaç, tarihi Galata bölgesi için bir yürünebilirlik endeksi geliştirilerek alanın mevcut mekansal yapısının ve yaya hareketlilik dokusunun değerlendirilmesidir.

Geliştirilen yürünebilirlik çalışması, yaya hareketleri dokuları, mekansal erişilebilirlik ve fiziksel çevre verileri olmak üzere 3 temel veri türü kullanmıştır. Mekansal erişilebilirlik olarak Mekan Dizim yöntemiyle elde edilen bütünleşme değerleri alınmıştır. Fiziksel veriler başlığı altında toplanan veriler, arazi kullanımı, eğim düzeyi, güvenlik, görsel kalite, çekicilik ve konfor olarak sıralanmaktadır. Çalışmanın son adımında, tüm veritabanını içeren ve yaya hareket düzeylerinin bağımlı değişken olarak ele alındığı bir çoklu regresyon analizi yapılmıştır.

Çalışmanın ilk adımı olarak, çalışma alanındaki yaya hareketi araştırılarak mevcut hareketlilik oranlarının ve mekansal kullanım dokularının bir şeması çıkarılmıştır. Bir gözlemci gru-

bu tarafından 55 noktada hafta içi bir gün ve hafta sonu bir gün olmak üzere yaya hareketinin düzeyi tespit edilmiştir. Her sayım noktası sabah 08:00 ile akşam 20:00 arasında iki saatlik zaman aralıklarında beş dakika süreyle gözlem-lenmiştir. Daha sonra sonuçlar gün boyunca iki saatlik zaman aralığında ortalama saatlik yaya hareketi oranlarını elde etmek için istatistiksel olarak incelenmiştir.

Mekansal erişilebilirlik değişkeninin analizinde, mekanın biçimlenmesinden kaynaklanan farklılıkları ölçen Mekan Dizim yönteminden faydalanılmıştır. Mekan Dizim yöntemi, mekanın erişilebilirliğini ölçerek mekana bütünleşme değerleri vermektedir. Bu yöntem, şehirselleşme tasarımında yardımcı bir araç olarak kullanılmaktadır. Mekan Dizim analizleri için çalışma alanının mekansal modeli hazırlanmış ve işleminden geçirilerek bir aks haritası elde edilmiştir. Yürünebilirlik araştırmasında erişilebilirlik, sayım yapılan her bir nokta için, aks haritasında o noktanın üzerinde bulunduğu "doğru"nun bütünleşme değeri olarak alınmıştır.

Fiziksel veriler olarak ilk etapta arazi kullanımı verisi elde edilmiştir. Çalışmada, arazi kullanımı, sayım yapılan her nokta için, o noktanın üzerinde bulunduğu "sokak parçası"nın sahip olduğu ticaret ve hizmet kullanımlarının adedi olarak hesaplanmıştır. Sokak parçalarının belirlenmesinde sokakların kırılma noktaları sınır olarak alınmıştır. Yayaların, kullandıkları güzergahları seçerken bilinçli veya bilinçsiz bir şekilde az eğimli veya iniş yönünde eğimli yolları tercih ettikleri kabul edilmektedir. Galata'nın eğimli bir araziye sahip olması nedeniyle çalışmada eğim faktörünün de değerlendirilmesi uygun görülmüştür. Eğim değerleri, gözlem noktalarının arazi üzerindeki gerçek kotları ile hesaplanmış ve her iki yöndeki hareket düzeyleri ayrı ayrı değerlendirilmiştir. Kentsel güvenlik konusunun tasarımda en önemli unsurlardan biri olması nedeniyle, yaya hareketleriyle karşılaştırmak üzere güvenlik verisi toplanmıştır. Güvenlik unsuru bu çalışmada ulaşım güvenliği ve asayiş olmak üzere iki ana başlık altında ele alınmıştır. Ulaşım güvenliği kapsamında, yaya ve taşıt ayrımı, trafik yoğunluğu ve karşıdan karşıya geçiş

olanakları trafikte yaya güvenliği düzeyinin belirlenmesi için incelenmiştir. Asayiş başlığı altında ise gerçek suç oranları ve fiziksel çevrenin yarattığı güvenlik hissi ayrı ayrı ele alınmıştır. Beyoğlu İlçe Emniyet Müdürlüğü'nden 2005 yılına ait suç oranları sokak bazında alınarak, sayım yapılan her noktanın üzerinde bulunduğu sokak için kayıtlara geçen toplam suç adetleri veri olarak girilmiştir. Bir yerdeki gerçek suç oranları, o yerin insanlarda uyardığı korku hissi ile aynı olmayabilmektedir. Korku, mekanın tasarım özellikleri ile azaltılabilmekte ve bazı tasarımlar insanlarda güvenlik hissi yaratmaktadır. Bu çalışma kapsamında fiziksel çevrenin güvenlik hissine etkisi araştırılmıştır. Bu doğrultuda, aydınlık düzeyi, fiziksel çevrenin canlılığı, bina cephelerinde aktif kullanım, potansiyel gizlenme yerlerinin varlığı, uzun görüş mesafesi, alanın sahipli ve bakımlı olması gibi göstergeler incelenmiştir. Görsel kalite, çekicilik ve konfor değerlendirmesinde, yaya yolunun genişliği, yaya yolunun malzemesi, yaya yolunun işçiliği, yolda devamlı engeller olması, yol üstü uygunsuz parklanma, bordür tipi, sokak aydınlatması, temizlik ve bakımlılık, bina tarzlarının benzerliği, yolun fiziksel olarak yürüme zorluğu yaratması, yürümek için ne kadar çekiç olduğu, kimlik, kapalılık, insan ölçeği, saydamlık, karmaşıklık ve gürültü düzeyi göstergeleri incelenmiştir.

Analizler sonucunda elde edilen veriler CBS veritabanında bir araya getirilmiştir. Oluşturulan veritabanı, tüm gözlem noktaları için, yaya hareketlerinin hafta içi ve hafta sonu, tüm kategoriler ve tüm saat dilimleri sonuçlarını, arazi kullanımlarını, Mekan Dizim yöntemi ile hesaplanan bütünleşme değerlerini, eğitim yüzdesini, güvenlik değerlerini ve görsel kalite, çekicilik ve konfor başlığı altında hesaplanan de-

ğerleri içermektedir. Çoklu regresyon modelleri arasında açıklama oranı en yüksek model hafta sonu sayımlarının toplam değerleri ile elde edilmiştir. Bu modelin yaya hareketlerine etki eden faktörleri açıklama oranı %60'tır. Modele göre, yaya hareket oranlarını, güvenlik, bütünleşme değerleri ve arazi kullanım değişkenleri belirlemektedir.

Araştırmanın sonuçları, Galata'nın merkezi konumunun, ticaret ve hizmet gibi merkez kullanımlarıyla güçlenmekte olduğunu ve bu kullanımların alanın yaya potansiyelini arttırdığını göstermektedir. Güvenli ulaşım, suç oranları ve güvenlik hissi unsurlarının birlikte ele alındığı güvenlik değişkeninin yaya hareketleri üzerinde önemli bir etkisinin olması da yine Galata'nın merkezi bir konumu olmasına rağmen yayalar tarafından az kullanılan تنها bir mekan olmasının sonucudur. Çoklu regresyon modelinin sonucunda, Mekan Dizim yöntemi ile matematiksel olarak ölçülebilir hale getirilen mekansal biçimlenme özelliklerinin yaya hareketleri üzerinde doğrudan bir etkisi olduğu saptanmıştır. Sonuçlar, Mekan Dizim yönteminin kentsel tasarım çalışmalarında yardımcı bir araç olarak kullanılmasının önemini bir kez daha kanıtlamaktadır.

Önerilecek kentsel tasarım projelerinde bu bulgular ışığında bir düzenleme yapılması, "erişilebilirliğin" önemle ele alınması ve önerilerde, tespit edilen mevcut eğilimler ve potansiyeller doğrultusunda alanın merkez konumuna hitap edecek ticaret ve hizmet kullanımlarına ağırlık verilmesi önerilmektedir. Bu çalışmanın, getirdiği yöntem ve elde ettiği bulgular ile, özellikle canlılığını yitirmiş tarihi kent merkezlerinde yapılacak incelemelere analitik bir temel oluşturacağına ve çalışmalara ışık tutarak bilimsel katkı sağlayacağına inanılmaktadır.