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Evaluating visitors' perceptions of squares: Evidence from Istanbul

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Abstract

The urban square has been a prominent research topic in the literature of public space for decades, with related research taking it into account mainly as a physical, social, and economic space. However, a very limited number of empirical studies take into account the spatial perception of visitors to squares. The main aim of this study is to fill this gap by determining the factors prominent in shaping visitors' perception of the attractiveness of urban squares. For this purpose, fourteen urban squares were selected as cases, and 644 randomly selected visitors of these squares were surveyed. Following this comprehensive survey, a binary probit model was used to model the visitors' binary perceptions of the attractiveness of the related squares. A correlative approach between such a comprehensive study and an econometric model would be novel in the case of Istanbul.

Keywords

Attraction to a public square, Visitors' perceptions of public squares, Binary probit model.

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1. Introduction

There exist in the literature a vast number of studies on urban squares, many of which have criticized the tendency to classify these squares based on the functions and forms of similar spaces on the grounds that such places are vital public spatial entities with functions much more vital than mere open space (Krier, 1979; Moughtin, 2003; Davies and Jokiniemi, 2008, p.284; Büyükcivelek, 2012; Douzdouzani et al., 2014). Subsequent literature has treated urban squares as prestigious spaces that have fed urban social life throughout history (Memlük, 2013), arguing that from the Greek agora to modern city centers, urban squares have served as basic representative spaces that accommodate all the political, economic, and social tracks of their societies, along with preliminary commercial, administrative, cultural, and recreational functions.

Urban squares are also treated as spatial entities that are physically shaped by social perceptions and related activities (Whyte, 1980; Douzdouzani et al., 2014). Studies espousing this view have come to prominence in the literature, placing human perception at the core of investigations of these spaces. The Gestalt theorem, which deals primarily with perception and related cognitive processes as they pertain to visual perception and spatial organization (Kürkçüoğlu, 2015), constitutes a prominent reference in these studies (Verstegen, 2005). The theorem posits that the stimulation of attention via human perception or sensation is vital,

Cüceloğlu (1991) defines the terms perception and sensation as the transformation of related external stimuli into reactions or behaviours, while Rapoport (1977) asserts that stimuli in the physical environment are transformed into perceptions through the effects of various physiological and socio-psychological conditions, affecting each individual uniquely.

The perception of an urban public spaces shaped primarily by the physical characteristics, forms, borders, width, liquidity, openness, closeness, duty cycles, materials, colours, and restrictive features of the related space. In addition, individual preferences and decisions play a vital role in a visitor's choice to visit such spaces and/or to evaluate them as impressive. The decision processes involved are explicitly shaped by individuals' aims, objectives, and environmental stimuli.

There are different approaches in literature to investigating the stimuli essential in shaping individual perceptions of urban public squares. According to some, the primary environmental stimuli within an urban space are the spatial forms present (Ittelson, 1974). Other approaches indicate that the users' physical and psychological characteristics, such as age, gender, perception, sensorial features, expectations, learning processes, spatial experiences, memory, and basic needs are as significant as the physical features of urban public spaces (Cullen, 1961; Lynch, 1960; Spreiregen, 1965; Rossi, 1966; Arnheim, 1977; Rapoport, 1977). More recent scholarship has aimed at finding the socio-spatial balance between stimuli. According to Wolfe & Horowitz (2004), the primary stimuli of attention in users' spatial perceptions are orientation and dimension, with light ratio, depth, form, closeness, and topological status acting as secondary factors and figure-ground, continuity, rhythm, similarity, closeness, sound, smell, and layout as tertiary factors. These stimulants are not only structured by geometrical and figural characteristics, but also by the non-figural features of the spaces. At the same time, all these stimuli play vital roles as different layers in determining the spatial perceptions of individuals (Kürkçüoğlu, 2015).

Liu (2013) claims that scale is as vital as aesthetics in constructing an urban public square as a spatial unit, as people respond to scale more than dimension; he concludes that scale and volume are the direct, explicit factors informing users' experiences and spatial perceptions. Similarly, Moughtin (2003) classifies urban squares through their related forms, as do Zucker (1959) and Sitte (1965). Specifically, Moughtin (2003) asserts that urban squares are expected to be proportional in size and categorizes them as enclosed, dominat-

ed, linked, linked by an external reference point, nuclear, and amorphous (Moughtin, 2003, pp. 99-123).

The spatial action of the individual can also be considered a significant factor in determining the role of space, in as much as action brings spaces to life (Gehl, 1987; Ayataç, 2016). Hence urban public squares are expected to provide a spatial environment that lends itself to easy perception and mobilization and permits socialization (Montgomery, 1998, p.98; Ayataç, 2016). Moreover, according to Whyte (1980), urban squares are often evaluated through their accommodation of user activities such as sitting and spending time in the square. Thus a combination of physical and social comfort may lead to a certain degree of attractiveness for visitors.

Afrooz, Hanaee & Parolin (2012) claim that users' spatial experience and familiarity with the spatial environment are essential as other factors, such as closeness, noise, brightness, density, and physical and social security, in the selection of the routes of related pedestrian movements. They also define the level of accessibility to related actions, activities, and equipment as a significant factor in shaping visitors' spatial perceptions of urban public spaces. Interestingly, they emphasize considerations such as social attributes, social relations, sociability, and sense of community less than other research in related literature.

Carmona (2018) and Carmona et al. (2019) assert that attractiveness in an urban public square depends on the parameters of continuity, diversity, follow availability, liberty, spatial definability, easy accessibility, comfort, and substance. Similarly, Nemeth & Schmidt (2011) argue that the stimuli that determine the spatial perceptions of the visitors can be discovered through public interest-based surveys. They define the relevant factors as surrounding land use, equipment enhancing the level of users' comfort (such as protection from strong solar rays, etc.), seating, food & beverage facilities, lighting, artistic elements, accessibility, follow availability, and security (Nemeth & Schmidt, 2011).

Other ongoing studies have claimed that the climatic comfort of public spaces is another significant factor in users' spatial perceptions. Many studies have used this claim as a justification for building underground public squares (Nikolopoulou et al., 2001; Knez & Thorsson 2006), streets (Gehl 1987; Nagara et al., 1996), and parks (Nikolopoulou et al., 2011; Thompson, 2002).

These varying perspectives have led to the establishment of four main indicators within two meta-themes: visitors and spaces. Socio-economic parameters come into prominence in the meta-theme of visitors. Geometrical features, physical characteristics, and function fall under the meta-theme of spaces. This study has been structured in accordance with this framework. Fourteen public squares were selected as case studies, from which 644 randomly selected visitors[1] were asked questions concerning the socio-economic features of visitors and the geometrical and physical characteristics and functions of the squares[2].

The dependent variable involved in this investigation was the perception of the surveyed visitors of the relevant public squares as attractive or not. Because of the binary nature of this variable, it was necessary to include a binary probit model structure. Four different binary probit models were thus used with reference to four different types of public squares—historical, Bosphorus Quay, coastal, and residential—with the aim of ascertaining the preliminary factors that determined the level of attractiveness for each type of square.

In accordance with this methodology, this article comprises five sections. Following the introduction, the data, materials, and method of the study are detailed. Subsequently, the findings of the models are established and evaluated. The last section offers concluding remarks about the main highlights of the article.

2. Case study area

The case studies were selected as representative areas of Istanbul, which contains 14,8 million people within a total area of 5,313 km^2. As the

[1] The validity of such a research dataset is derived from the random selection of a large number of respondents, each visiting an urban public square.

[2] All the related independent variables in this article spring from this background in the literature, and the related dataset was gathered by field surveys adhered to in the Scientific Research Project (Type A Project, reference number: 39974, dated in 2018) at Istanbul Technical University. The definitions and measurement units of these independent variables have been determined based on the questionnaires conducted in these field surveys (see Table 1).

connection between Asia and Europe, Istanbul is very strategically positioned in both a spatial and socio-political sense. Until the 4th Century (AD), the city contained distinctively designed public squares known as fora. These fora had differentiated administrative, symbolic, and functional roles which shaped socio-spatial developments on an urban scale (İgus, 2014). Urban public squares were used as spaces facilitating athletic activities, ceremonies, and celebrations until the 19th century in Istanbul; new squares have been designed and spatially specialized with the aid of European trends and of designers since the beginning of 20th century. Even though some design principles, such as symmetrical texture, spatial order, and widespread usage of monuments, have been adopted within the European squares, the topographical characteristics of the urban environment and the self-social characteristics of the local urban societies have been disregarded. The Aksaray square, Beyazıt square, Sultanahmet square, Eminönü square, Karaköy square, Taksim square, and İskele square located in the periphery of the Kadıköy ferry were spatially re-planned (Kuban, 1998).

The generation and rearrangement of urban public squares has also been taken into account during the preparation processes of urban development plans during the Republican period in Turkey, e.g. in the Eminönü, Beyazıt, Sirkeci, Aksaray, Sultanahmet, Unkapanı, Şişhane, Taksim, Dolmabahçe, Kabataş Pier, Barbaros, and Harbiye squares (Cumhuriyet Devrinde İstanbul, 1949). In accordance with this history and a review of the relevant literature, the focus in this study is on the Kadıköy, Taksim, Beylerbeyi (Tapan, 2014), and Bosphorus quay squares and the Anatolian Fort (Ayataç et al, 2018), along with and historical (İnceoğlu, 2007; Özbil et al., 2013) and socio-political squares such as the Eminönü and Sultanahmet squares (Özbil et al., 2013; Saylan & Erdönmez, 2017).

Fourteen urban squares in all in Istanbul were selected as case studies and have been classified according to the following categories; historical urban squares, Bosphorus quay squares, coastal squares, and residential squares. As indicated in Figure 1, Sultanahmet, Beyazıt, Eminönü, and Taksim were selected as representative historical urban squares; the Üsküdar, Beykoz, Ortaköy, and Sarıyer squares comprise the Bosphorus quay squares; Büyükada and Kadıköy are representative of the coastal squares; Lastly, the Kadıköy

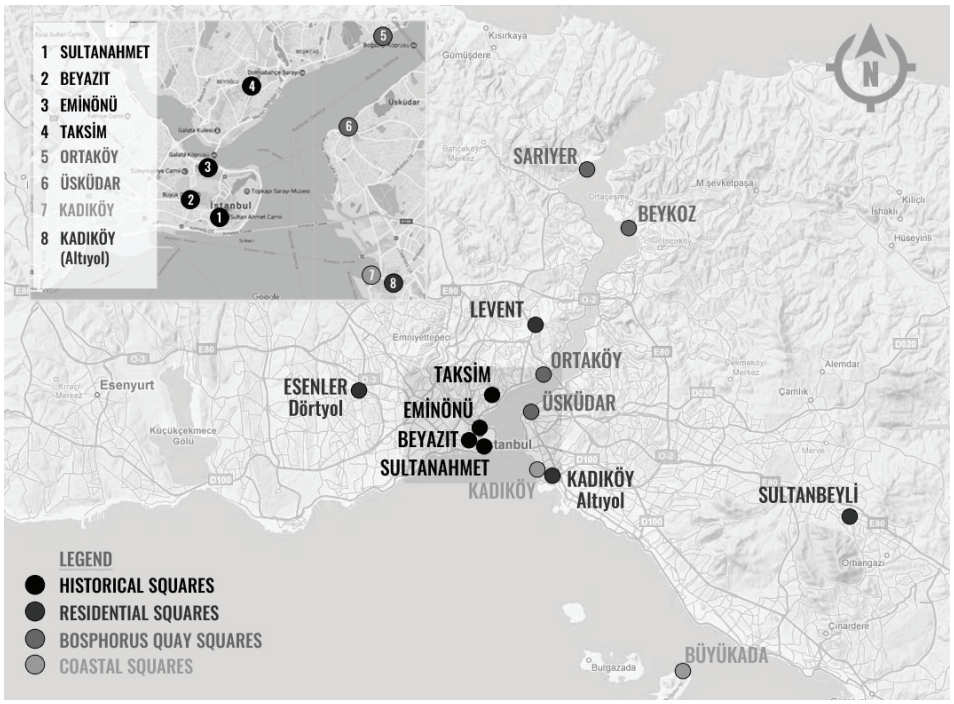

Figure 1. *Selected public squares.*

Altıyol, Esenler Dörtyol, Sultanbeyli and Levent squares have been selected as representative of residential squares.

The case studies were compared with respect to their construction periods, dimensions (base area), basic physical forms, morphological features,and other figural characteristics. The Eminönü, Sultanahmet, Beyazıt, Üsküdar, Kadıköy, and Ortaköy squares were constructed before Turkey's Republican period, and their forms and dimensions have been altered throughout different periods (Figure 2).

Taksim square was formed during the establishment of the Republic of Turkey. The Beykoz, Esenler, and Levent squares were constructed in the 1950s and have since been used as public squares. The Beyazıt, Taksim, and Üsküdar squares, with base areas larger than 25,000 m^2, are categorized as large. The Sultanahmet, Beyazıt, Ortaköy, and Kadıköy squares facilitate a mixed type of functions, while the Beykoz and Sarıyer squares exist only for recreational purposes. Almost all the selected squares exhibit non-amorphous spatial patterns in their geometrical forms. In addition, nearly all these squares act as entrances in their morphological characters.

3. Data, materials and method

In accordance with the research question of the article, the prevailing factors for the visitors' perceptions of attractiveness were investigated in fourteen different urban squares. 644 semi-structured surveys were conducted with the participation of randomly selected visitors.

3.1. Model variables

Attractiveness is the dependent binary variable for this study, assessing whether the visitor perceives the urban space as an attractive one (1) or not (0). The research also includes 28 independent variables (see Table 1). As indicated in the introduction, these independent variables can be placed in four main categories: *socio-economic parameters, functional properties, geometrical features, and physical characteristics* (Table 1), all of which were derived from reviews of relevant literature. Visitors' socio-economic characteristics include gender, age, and education level. The functional properties analyzed include commercial, recreational, cultural/touristic, religious, reference point, and circulation. Geometrical features are categorized according to the geometrical forms of the relevant squares (e.g. quadrangle, linear, and amorphous). Remaining features are categorized as physical characteristics.

3.2. Method

The dependent variable of the research is a binary variable that is not Gaussian distributed; such a variable can be modelled through a binary probit model, which gives the estimated values of the probability that any randomly selected individual will perceive his or her visited square as attractive.

In any multi variable linear

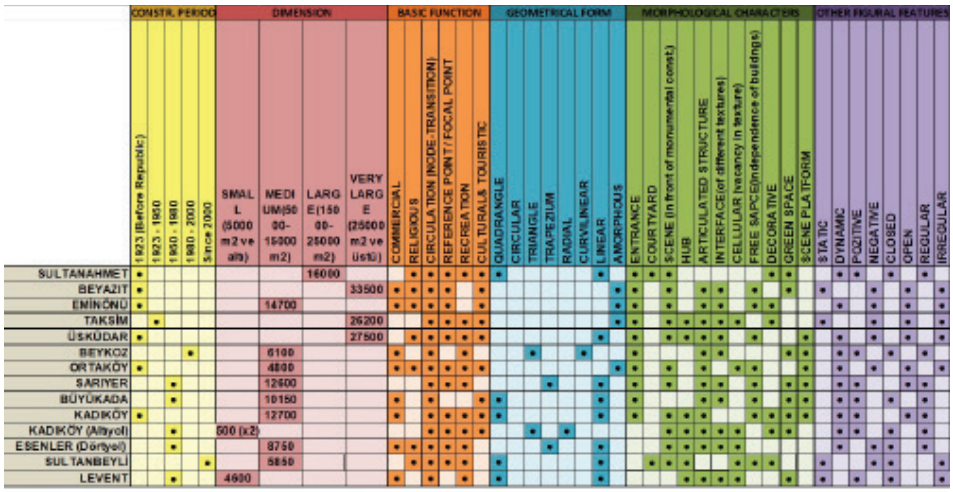

Figure 2. *The Characteristics of the selected public squares.*

regression model, the dependent variable is normally a distributed variable rather than count or binary. However, in binary probit regression models, the dependent variable is binary. As the dependent variable of this study is binary—visitors can find squares attractive (1) or unattractive (2)—a binary probit regression model is appropriate (Cameron & Trivedi, 2005, pp.464-471). Herein, the probit model, indicated with the symbol Φ(Xp x βp), asserts a *conditional probability function:*

$$\text{Conditional probability} = p = \phi(X_p \times \beta_p) = \int_{-\infty}^{X\beta} \phi(z)\,\partial z. \quad (1)$$

In equation 1, Φ(.), represents a kind of standard normal cumulative distribution function (cdf). y_i is the dependent variable representing the perceptions of the visitors, with X_i as the combined vector involving all the related independent variables, which can be modelled by the *Maximum Likelihood* (ML) estimation. The *first order condition* of this estimation is represented by:

$$\sum_{i=1}^{i=N} \text{Wi}\,[\text{Yi} - \phi(\text{Xi} \times \beta)]\,\text{Xi} = 0,$$

$$\text{where Wi} = \frac{\phi(Xi\ x\ \beta)}{\phi(Xi\beta)\ x\ [1-\phi(Xi\beta)]}, \text{ and} \quad (2)$$

$$\text{where } \phi(z) = \frac{1}{2\pi} \times e^{[(-z\hat{}2)/2]}$$

Lastly, the *marginal effect* estimates in probit models are determined through the following formula: (Cameron & Trivedi, 2005).

$$\frac{\partial Pi}{\partial Xij} = \phi\,[\phi^{-1}(\text{Xi} \times \beta)] \times \beta j, \text{ where } P_i = X_i \times \beta \quad (3)$$

4. Result and discussion

In this section, the results of four binary *probit* regression models are discussed for each of the location categories of the public squares (see Figures 1 and Figure 2). The estimations of the models are the marginal effect of each factor in the probability of a visitor perceiving the public square in question as attractive.

Table 1. *Variable definitions*[3].

Variable	Type of the Variable	Variable Definition	Measurement Unit
Gender of the individual	dummy variable	1: female, 0: male	0 or 1.
Age	categorical variable	1: 15-24, 2:25-34,3:35-44, 4:45-54, 5: 55-64, 6: 64+	1,2,3,4,5, or 6.
Education level	ordered variable	1: illiterate, 2: literate, 3: primary school, 4: elementary school, 5: highschool, 6: associate bachelor degree, 7: bachelor degree, 8: master & phd degree	1,2,3,4,5,6,7, or 8.
Mode of travel to the related square	categorical variable	1: pedestrian, 2: bicycle-motorcycle, 3: private automobile, 4: public transport	1,2,3, or 4.
Easy Accessibility	scale variable	1: not accessible, 2: weakly accessible, 3: moderately accessible, 4: accessibl, 5: highly accessible	1,2,3,4, or 5.
Cleanliness (overhaul)	scale variable	1: not clean, 2: weakly clean, 3: moderately clean, 4: clean, 5: highly clean	1,2,3,4, or 5.
Unobstructed pedestrian movement	scale variable	1: obstructed, 2: poorly unobstructed, 3: moderately unobstructed, 4: unobstructed, 5: strongly unobstructed	1,2,3,4, or 5.
Historical Identity	scale variable	1: no historical, 2: poorly historical, 3: moderately historical, 4: historical, 5: strongly historical	1,2,3,4, or 5.
Artistic Identity	scale variable	1: no artistic identity, 2: weak artistic identity, 3: moderate artistic identity, 4: artistic identity, 5: strong artistic identity	1,2,3,4, or 5.
Security	scale variable	1: no securityity, 2: weak security, 3: moderately secure, 4: secure, 5: strongly secure	1,2,3,4, or 5.
Follow availability (spatial orientation)	scale variable	1: no spatial orientation, 2: weak spatial orientation, 3: moderate spatial orientation, 4: spatially oriented, 5: strong spatial orientation	1,2,3,4, or 5.
Construction Period	dummy variable	0: Pre-republic, 1: Post-republic	0 or 1.
Base Area Category (dimension)	categorical variable	1: small (<5,000 m²), 2: medium size (5,000 m²-15,000 m²), 3: large (15,000 m²- 25,000 m²), 4: very large (>25,000 m²)	1,2,3, or 4.
Functional Properties (preliminary function)			
Commercial_dummy	dummy variable	1: if commercial, 0: otherwise.	0 or 1.
Recreation_dummy	dummy variable	1: if commercial, 0: otherwise.	0 or 1.
Cultural_touristic_dummy	dummy variable	1: if cultural & touristic, 0: otherwise.	
Religious_dummy	dummy variable	1: if religious, 0: otherwise.	0 or 1.
Reference_Point_Dummy	dummy variable	1: if strong reference point 0: otherwise.	0 or 1.
Circulation_dummy	dummy variable	1: if strong circulation (node or transition), 0: otherwise.	0 or 1.
Geometrical Forms			
Quadrangle_form_dummy	dummy variable	1: if quadrangle, 0: otherwise.	0 or 1.
Linear_form_dummy	dummy variable	1: if linear, 0: otherwise.	0 or 1.
Amorphous_form_dummy	dummy variable	1: if amorphous, 0: otherwise.	0 or 1.
Morphological Character			
Morphological_character_number	count variable	Number of the related morphological characters that are explicitly observed in the urban square. These are, namely, entrance, courtyard, stage (in front of a monumental building), hub, articulated structure (with many different spatial pieces),	1,2,3,4,5,6,7,8,9,10, or 11.

[3] *The definition (and related measurement units) of each independent variable in the table derives the content and the related assessment criteria of each question -asserted in the field survey- with refers to different characteristic/ feature of the related public square. The field survey has been conducted inhered to the Scientific Research Project in İstanbul Technical University and the independent variables of Table 1 has directly been derived from the questionnaires of this field survey.*

Table 1 (Continued). *Variable definitions.*

		interface (spatial intersection of different patterns), cellular (spatial gaps) structure in pattern, decorative, free space (building independent), green space, scene platform	
Others			
Closed_dummy	dummy variable	1: if spatially closed , 0: otherwise.	0 or 1.
Category of the square	categorical variable	1: if historical square, 2: if Bogazici pier square, 3: if coastal square, 4: if square of settled pattern	1,2,3, or 4.
Average Passing Time	categorical variable	1: 0-15 min., 2: 15-30 min., 3: 30-45 min., 4: 45-60 min., 5: 60-120 min., 6: 120-240 min., 7: 240+ min.	1,2,3,4,5,6, or 7.
Seasonal compatibility	scale variable	1: no compatibility, 2: weakly compatible, 3: moderately compatible, 4: compatible, 5: strongly compatible.	1,2,3,4, or 5.
Security	scale variable	1: no compatibility, 2: weakly compatible, 3: moderately compatible, 4: compatible, 5: strongly compatible.	1,2,3,4, or 5.

4.1. Results of the binary probit models for location categories of urban squares

Four binary probit regression models were conducted for each location category: historical urban, Bosphorus quay, coastal, and residential squares. The main purpose of these models was to evaluate the attraction levels of the public squares.

The results indicated that the prevailing factors forming the perceptions of the individuals differ significantly between these categories (*see* Table 2).

4.1.1. Results for historical urban squares

The results of the model for historical urban squares revealed six significant factors affecting visitor perceptions: *cleanliness, seasonal compatibility, security, dimension, and commercial and religious functions* (Table 2).

Of these factors, *commercial function* (0.6 %), *cleanliness* (0.2 %), *security* (0.2 %), *seasonal compatibility* (0.13 %) have a positive effect on visitor perception. On the other hand, *religious function* (-0.8 %) and *dimension* (-0.9 %) negatively influence the perception of the attractiveness of public squares.

In other words, as the dimension increases, the spatial perception of the visitors weakens accordingly. *Cleanliness, security,* and *seasonal factors* are also prominent, as in the literature.

4.1.2. Results for Bosphorus Quay Squares

Five factors appear significant when the model is applied to Bosphorus Quay Squares (Table 2): *cleanliness* (1.8 %), *unobstructed pedestrian movement* (0.8 %), *spatial orientation* (0.8 %), *artistic identity* (0.63 %), and *mode of transportation* (0.6 %).

The factor *mode of transportation* appears a significant factor solely for Bosphorus Quay Squares, indicating the necessity of integrating the prevailing urban transport networks with the Bosphorus Quay Squares in Istanbul. *Cleanliness* appears to hold a stronger influence over perceptions of these quay squares, with lesser influence wielded by *unobstructed pedestrian movement* and *spatial orientation*.

4.1.3. Results for coastal squares

Four preliminary factors appear to hold sway over perceptions of coastal squares: service as *location reference point* (46 %), *unobstructed pedestrian movement* (21 %), *spatial orientation* (15.8 %), and *gender* (0.157 %) (Table 2). *Age* exhibits negative effect on the perceptions of the visitors to these squares (-4.7 %).

The preliminary function of an urban square as a spatial reference point (especially in defining spatial addresses) and the provision of a spatial environment conducive to continuity in physical movement bring to enormous advantages for coastal squares, which has not been the case for any other type of square.

Moreover, visitors' demographic characteristics correlate more strongly with perception for coastal squares. *Female* visitors seem to be 15.7 % more likely to perceive coastal squares as attractive than male visitors. Moreover, as the *age* of visitors increases (Table 1), the likelihood that they will perceive the coastal square as attractive decreases significantly. In other words, younger visitors prefer such squares.

4.1.4. Results for residential squares

The results of the model for residential squares indicate four promi-

nent factors: unobstructed pedestrian movement (8.3 %), accessibility (6.8 %), security (6.1 %), and seasonal compatibility (4.8 %).

The effect of *unobstructed pedestrian movement* in residential squares is much higher than in the Bosphorus Quay Squares, but much lower than in coastal squares. Furthermore, *accessibility* is a significant factor for the first time in the cases of residential squares, as a lack of accessibility would pose more of a problem to visitors of these areas. *Seasonal compatibility* and *security* (see Table 1) are much stronger factors in residential squares than in historical urban squares (Table 2), which may indicate dramatic increases in security and climate problems in these squares. Obviously, more measurement is required on this front.

Table 2*. *Binary Probit Model Results[4] for each Category of Square (*Just significant factors are exhibited, remaining insignificant factors have been deleted from table).*

	Number of obs	242		**Number of obs**	122		**Number of obs**	80		**Number of obs**	121	
	Wald chi2(17)	455.88		**Wald chi2(15)**	47.17		**Wald chi2(15)**	35.09		**Wald chi2(16)**	32.94	
	Prob > chi2	0.0000		**Prob > chi2**	0.0000		**Prob > chi2**	0.0024		**Prob > chi2**	0.0075	
	Log pseudolikelihood	-43.58697		**Log pseudolikelihood**	-16.631317		**Log pseudolikelihood**	-31.394208		**Log pseudolikelihood**	-45.137093	
	Pseudo R2	0.5562		**Pseudo R2**	0.4368		**Pseudo R2**	0.3576		**Pseudo R2**	0.2973	
Variable / Category	**Historical Urban Squares**			**Bogazici Pier Squares**			**Coastal Squares**			**Urban Squares of Settled Pattern**		
	Coef.	**z**	**ME [5]**	**Coef.**	**z**	**ME**	**Coef.**	**z**	**ME**	**Coef.**	**z**	**ME**
Gender_dummy	-.01914	-0.06	-.0000805	.4463096	1.11	.0058903	.6148214	1.59	.1569971	.3188058	0.99	.0702412
Age	.0461205	0.44	.0001939	.0446431	0.30	.0005892	-.1837287	-1.51	-.0469159	-.0430407	-0.44	-.0094833
Education Level	-.075601	-0.60	-.0003179	-.021278	-0.18	-.0002808	.0334935	0.22	.0085527	.0455577	0.40	.0100375
Mode of travel to the related square	.0345085	0.47	.0001451	.4706003	2.01	.0062109	.0891767	0.63	.0227716	.0273766	0.36	.0060318
Average Passing Time	.2233682	1.29	.0009393	.3535934	1.41	.0046667	-.078772	-0.42	-.0201147	.0775632	0.97	.0170892
Easy Accessibility	.1567259	0.77	.000659	.0339239	0.13	.0004477	-.1867836	-0.70	-.0476959	.3114688	1.76	.0686247
Cleanliness (overhaul)	.4659413	2.81	.0019593	1.331568	2.78	.0175738	.1410973	0.75	.0360297	.2199595	1.23	.0484628
Unobstructed pedestrian movement	.2734574	1.27	.0011499	.6687654	1.97	.0088262	.8241968	3.18	.2104619	.3757365	2.18	.0827845
Seasonal Compatibility	.3165898	1.75	.0013313	-.1591833	-0.73	-.0021009	-.3803145	-1.40	-.0971148	.2198727	1.58	.0484437
Historical Identity	.1643957	0.89	.0006913	.3006078	0.54	.0039674	.2036139	0.85	.0519936	.08981	0.61	.0197875
Artistic Identity	.1248251	0.68	.0005249	.4755078	1.65	.0062757	.2997692	1.17	.0765472	.1260735	0.75	.0277773
Security	.4633848	2.57	.0019486	.2738746	0.93	.0036145	-.1192336	-0.42	-.0304468	.2787501	1.77	.0614159
Follow availability (spatial orientation)	.0789225	0.50	.0003319	.5687151	2.26	.0075058	.6195943	2.30	.1582158	.2277874	1.14	.0501875
Commercial_dummy	1.413466	2.63	.0059437	.8087577	1.18	.0106738	0 (omitted)		0	-.8972879	-0.62	-.1976959
Religious_dummy	-1.887089	-3.26	-.0079353	0 (omitted)		0	0 (omitted)		0	0 (omitted)		0
Base Area Category (dimension)	-2.054148	-8.65	-.0086378	0 (omitted)		0	0 (omitted)		0	0 (omitted)		0

5. Conclusion

Following the suggestion of Nemeth & Schmidt (2011) that the stimuli shaping the spatial perceptions of the visitors can be determined through public interests-based surveys, this study models the binary perception of visitors to urban squares, asking whether they perceive the visited squares as attractive or not as part of a public interests-based field survey conducted in Istanbul. Fourteen public squares were selected as case studies, from which 644 randomly selected visitors were surveyed. An econometric binary probit model was used to account for the binary views of the visitors through various independent factors. For this purpose, four main indicators were utilized within two meta-themes: visitors and spaces. In the meta-theme of visitors, socio-economic parameters are paramount. The parameters of geometrical features, physical characteristics, and function comprise the meta-theme of spaces. This framework has not yet been explored in the related literature. Moreover, the empirical research of the prevailing literature has only been able to examine case-specific studies which took into account only the descriptive statistics of the reviews of randomly selected visitors of only the squares selected. However, this article proposes econometric model-based empirical research on visitors' perspectives of urban public squares for the first time in the literature. Through this method, the strong tools of inferential statistics —with the aid of the binary probit model— were utilized to infer scientific generalizations for categories of urban squares within a confidence interval, allowing for the inference of representative results for all public squares in Istanbul.

According to the results, socio-economic parameters (*age, gender, and education level*) affect the perception of attractiveness of public squares by just 0.045 % in total. In addition, according to the findings of our model, the factors included under the category of *physical characteristics* display an effect of 16.92 % in total. These two findings explicitly dispute those of Cullen (1961), Lynch (1960), Spreiregen (1965), Rossi (1966), Arnheim (1977), and Rapoport (1977), which argue that users' so-

cio-economic characteristics such as age, gender, perceptions, sensorial features, psychological characteristics, expectations, learning processes, spatial experiences, memory, and basic needs are as prominent in the perception of attractiveness as the physical features of urban public spaces.

Secondly, *functional properties* (commercial, recreational, cultural/touristic, religious, reference point, and circulation) affect individual perceptions of the *attractiveness* of the squares by 23.12 % in total, which indicates that the individual's decision processes are explicitly shaped by their aims and objectives, which act as perceptual stimuli in the cases of the functional split of these squares. This finding confirms the argument of Krier (1979), Moughtin (2003), Davies & Jokiniemi (2008), Büyükcivelek (2012), Memlük (2013), and Douzdouzani et al. (2014) that public urban squares are vital public spatial entities with enriched functions rather than mere open spaces—the prestigious spaces that feed urban social life.

The effect of *geometrical forms—quadrangle*, *linear*, and *amorphous*—is 11.8 %. This finding confirms Kürkçüoğlu's (2015) conclusion that the geometrical and figural characteristics of public squares behave as significant stimuli in human spatial perceptions.

The categorical splits of public squares indicate differing significance in stimuli for each square type. The preservation of the current cultural heritage and related historical values comes into prominence for historical urban squares. In addition to historical, cultural, and symbolic values, the historical squares —Sultanahmet, Beyazıt, Eminönü, and Taksim— depend heavily on *cleanliness* and *security.* While the positive effect of security on user perception falls in line with the arguments of Nemeth & Schmidt (2011) and Afrooz, Hanaee & Parolin (2012), *cleanliness*, whose importance in perception is not recognized in the prevailing literature, appears prominent in the perception of Istanbul's historical squares as attractive.

Moreover, in the case of Bosphorus Quay Squares, represented by the Üsküdar, Beykoz, Ortaköy, and Sarıyer squares, the factors that significantly shape the views of visitors are *accessibility* and *artistic identity*. This conclusion is in line with the argument of Nemeth & Schmidt (2011) that accessibility and artistic facilities are significant factors shaping visitors' spatial perceptions.

Furthermore, the factors *unobstructed pedestrian movement* and *service* as a *spatial reference point* stand out in perceptions of coastal squares such as those in Büyükada and Kadıköy. The reason behind the importance of these factors might be that no well-integrated pedestrian-friendly spatial network has seen construction in these coastal squares, heightening visitors' focus on this weakness. These coastal cases are also well-integrated into the sea transportation facilities of Istanbul, leading to their identification as *spatial reference* points by passengers. These findings for the Büyükada and Kadıköy squares explicitly validate the indications of Gehl (1987), Montgomery (1998), Afrooz, Hanaee & Parolin (2012), and Ayataç (2016) that the spatial action of the individual is a significant factor in designating the role of space, as action brings spaces to life. Urban public squares are thus expected to provide a spatial environment that accommodates easy perception, mobilization, and socialization.

Lastly, accessibility to the current public transit network of Istanbul and spatial *adaptation to any seasonal condition* are significant factors in the positive perception of residential squares, which in this study include the Kadıköy (Altıyol), Esenler (Dörtyol), Sultanbeyli, and Levent squares; this type of square hosts all types of seasonal daily social activities for urban communities, leading to the significance placed on these considerations by such communities. These findings support arguments of Gehl (1987), Nagara et al. (1996), Thompson (2002), Knez & Thorsson (2006), and Nikolopoulou et al. (2011) that the climatic comfort of public spaces is a significant factor in shaping the spatial perceptions of visitors.

To summarize, *the physical features of squares and socio-demographic fea-*

[4]The estimations have been obtained by the latest version of STATA program (STATA 15), which is a widely used pogram for especially advanced econometric models by the scientists.

[5] Marginal Estimations (ME) is the effect of each factor in probability of a visitor to perceive the related public square as an attractive one and is indicated in percentage. To illustrate, for historical urban squares – with reference to factor cleanliness- the coefficient is 0.0019593, which is approximately equal to 0.002, is able to be represented by 0.2 % in per cent.

tures such as the age, gender, and *education level* of the visiting communities have not been shown to be prominent factors influencing perception in the case of Istanbul, unlike in the empirical research of literature on the urban squares of developed countries. Such a difference might be explained through an understanding that public squares are mostly considered accessible rather than attractive spaces by various age groups and genders in Istanbul. If these squares were instead considered attraction points to be actively occupied by different age groups, they would be able to serve as liveable public spaces for urban communities in Istanbul. However, the factors *visual accessibility* and *compatibility* with the various climatic conditions have become significant, which is in line with the findings of the latest prevailing research of the relevant literature.

In light of these findings, this article confirms that urban public squares are not only spatial entities of physical design, but also of social perception. The research carried out is comparable that found in relevant literature that investigates public space and therefore contributes to the existing body of knowledge.

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