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Parks' Thermal Comfort and User Perceptions of Comfort in "Most-Used" Parks of Izmir

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ÖZET

Mahalle parkları İzmir gibi Akdeniz ikliminin hakim olduğu bölgelerde yaşam çevresine yakın mesafede yüksek seviyede serinletme etkisine kolay erişim sağlar. Literatür bu gibi yüksek ısıl konfor sağlayan mekanların daha fazla kullanıcı çektiğini savunur. Ancak her bir mahalle parkında ısıl konfor olduğu varsayılamaz. Parklarda ısıl konfor sağlamak ve iyileştirmek için parkın konumu ve sunduğu donatılar ve bitki örtüsü ile birlikte mekansal tasarımına çok özenle dikkat edilmeli ve kullanıcıların konfor anlayışına göre tekrar değerlendirilmelidir.

İzmir'in park yönünden zengin olan üç ilçesinde gerçekleştirilen bu alan çalışması parkları kullanan kişi sayısı ve kullanıcıların ısıl konfor algısının, parkların fiziksel özellikleri ile nasıl ilişkilendiğini araştırır. Çalışma temelde iki kısımdan oluşur ve t-testleri ile 95 parkta yapılan gözlem çalışmaları ile tespit edilen kullanıcı sayıları ve 42 parkta yapılan kullanıcıların demografik yapıları ile davranış şekilleri analiz sonuçlarının bu parkların sunduğu donatılar ve yumuşak peyzaj öğeleri ile nasıl ilişkilendiğini inceler. Daha sonra görece olarak daha fazla kullanıcı sayısına sahip dokuz parka odaklanarak, çalışma analizimiz parkların çoğunluğunda yapılı çevre elemanları (etraftaki bina yükseklikleri, park yönelimleri gibi), peyzaj öğeleri ve malzeme seçimleri ile sağlanabilecek ısıl komforun zayıf olduğunu göztermektedir. Aynı zamanda 2127 kullanıcı ile yapılan anket çalışmasına göre, kullanıcıların yaklaşık üçte birlik kısmının (çoğunlukla kadın ve çocuk) parkların ısıl konforundan şikayetçi olduğunu ve iyileştirme istediklerini göstermektedir. Çalışma son olarak da parklardaki algılanan ısıl konfor seviyesinin ve parkın fiziksel özellikleri ve kullanıcıların cinsiyet ve yaşları ile olan ilişkisini tartışır.

Anahtar Sözcükler: Park,Isıl Konfor, Kullanıcı Algıları

ABSTRACT

Neighborhood parks can provide residents with an easy access to high level of cooling effect nearby their houses in cities such as Izmir with Mediterranean climate. The literature in general expects that those open spaces with higher thermal comfort attract more users. However, presence of thermal comfort at each park is not given. To provide and improve parks' thermal comfort, parks' location and spatial design with amenities and vegetation must be paid attention objectively and also according to user perception of thermal comfort.
Evolving in three park-rich districts of Izmir, this case study investigates how number of users and user perception of thermal comfort in parks relate to those parks' physical characteristics. It has two stages: With t-tests, it analyses whether and how observed number of users in 95 parks and also demographic and behavioral characteristics in 42 parks in-use relate to these parks' amenities and green landscape. Then, focusing on nine parks with relatively highest number of users, our analyses show that most of these parks lack thermal comfort shaped typically by urban geometry (i.e., building height, street orientation), kind of vegetation as shading elements and choices of materials. However, out of surveys with 2127 users in these parks, around a third of responses (usually women with children) complain and/or expect more about parks' thermal comfort. We discuss the findings about objective and perceived thermal comfort level of parks in relation to park amenities and users' gender and age related characteristics.

Keywords: Parks, Thermal Comfort, User Perceptions.

INTRODUCTION

Neighborhood parks can provide residents with an easy access to high level of cooling effect nearby their houses in cities such as Izmir with Mediterranean climate. The literature in general expects that those open spaces with higher thermal comfort attract more users. However, presence of thermal comfort at each park is not given. To provide and improve parks' thermal comfort, parks' location and spatial design with amenities and vegetation must be paid attention objectively and also according to user perception of thermal comfort.

This study focuses on neighborhood parks as outdoor areas. Also, it talks mostly about users' sensation of thermal radiation (especially with sun and shade) as observed in their expression of "comfort" of the park area. Neighborhood parks as green public spaces can provide the residents of that area with an easy access to a considerable level of cooling effect in cities with hot climate, such as Izmir at the Aegean coast of Turkey.

However, whereas proportion and kind of green landscape features and of other park facilities vary at each park, the presence of thermal comfort at each park is not guaranteed even objectively. Also, regardless of their low level of thermal comfort, parks attract users also for other benefits such as resting, socializing, walking, playing and jogging, because of for instance personal preferences of park uses or availability and number of parks in that area.

Evolving in three park-rich districts of Izmir, this case study investigates how number of users and user perception of thermal comfort in parks relate to those parks' physical characteristics expected to affect thermal comfort there. The study has two stages. Firstly, with t-tests, it analyzes whether and how observed number of users in 95 parks and also demographic and behavioral characteristics in 42 parks in-use relate to these parks' amenities and green landscape. Then, focusing on nine parks with relatively highest number of users, our design analyses show that most of these parks lack thermal comfort shaped typically by urban geometry (i.e., building height, street orientation), kind of vegetation as shading elements and choices of materials.

ROLE OF THERMAL COMFORT IN THE USE OF NEIGHBORHOOD PARKS

Design of outdoor spaces with certain degrees of comfort is important to attract more people. Encouraging more people in outdoor spaces is important for a wide variety of benefits they can get and also for lively, sustainable and sociable cities. As part of these efforts, providing outdoor thermal comfort is both a challenge and a goal for the disciplines related to design of environment (1, 2).

Related to thermal comfort in outdoor spaces, pedestrians face with various environmental factors with variations of air temperature, thermal radiation (especially with sun and shade), wind speed and humidity (3). People's sensations of these factors and thus, of microclimate, shape their decisions of using outdoor spaces or not (4). Based on these concerns, there are more studies measuring climatic parameters of spaces and thus, about objectively assessing and modelling outdoor thermal comfort (5). These are studies in the fields of urban climatology and biometeorology.

However, objective climatic conditions are not enough to evaluate thermal comfort. Outdoor thermal comfort in urban environment has multiple layers ranging from physical to physiological, psychological and socio/behavioral (6, 7). Overall, whereas environmental characteristics especially microclimatic conditions and also the design of physical environment are major factors in shaping people's assessment of thermal sensations and comfort, so are the personal characteristics. The studies on behavioral aspects of outdoor thermal comfort aim to address and measure people's behavior in variations of microclimatic conditions. To emphasis human factor in assessing thermal comfort, these studies propose also the idea of thermal adaptation at the levels of physical, physiological and psychological and use this idea to

explain differences among users of any same outdoor space (8). Moreover, other characteristics of spaces (such as number of people, kind and design of facilities) and users' use purposes of that space (for sitting, standing, smoking), social characteristics of people (such as age, sex, working or not) and also with whom they come to that space can affect people's perception and sensation of thermal comfort there (e.g. 9). Some of these studies also underline the location or urban environment of outdoor spaces, such as being in a sea side or crowded metropolitan city (5).

To provide and improve parks' thermal comfort, parks' location and spatial design with amenities and vegetation must be paid attention objectively and also according to user perception of thermal comfort. The literature overall underline certain mitigation strategies to improve urban or outdoor thermal comfort (3), which can also be easily adaptable to park areas. Each strategy has different effects on thermal radiation, air temperature, wind speed and humidity. These strategies are (i) high and dense urban geometry often to block solar radiation and to reduce wind speed (especially, height-to-width ratio or the ratio between height of building and the width of street, E-W versus S-N orientation of streets) and mostly to ; (ii) vegetation in open spaces are to block radiation, reduce wind speed and also air temperature; (iii) reflective surface with natural or artificial materials to reduce solar radiation and air temperature; (iv) water bodies to cool the air and reduce radiation (3).

STUDY METHOD AND SITE

For this paper we use data from our research project about Izmir's neighborhood parks (supported by TÜBİTAK, project no.215K239) between 2016 and 2019. During the project, we identified 3 districts with relatively higher number of park areas per capita and also higher percentages of children or elderly and with different degrees of education level among women. In these neighborhood districts of Bornova, Karşıyaka and Izmir, we completed observations first at 97 and then at 33 out of these parks as the "highly used" parks. These observations (total 8 visits) were about physical features in and around parks and also number of park visitors at the time of field observation.

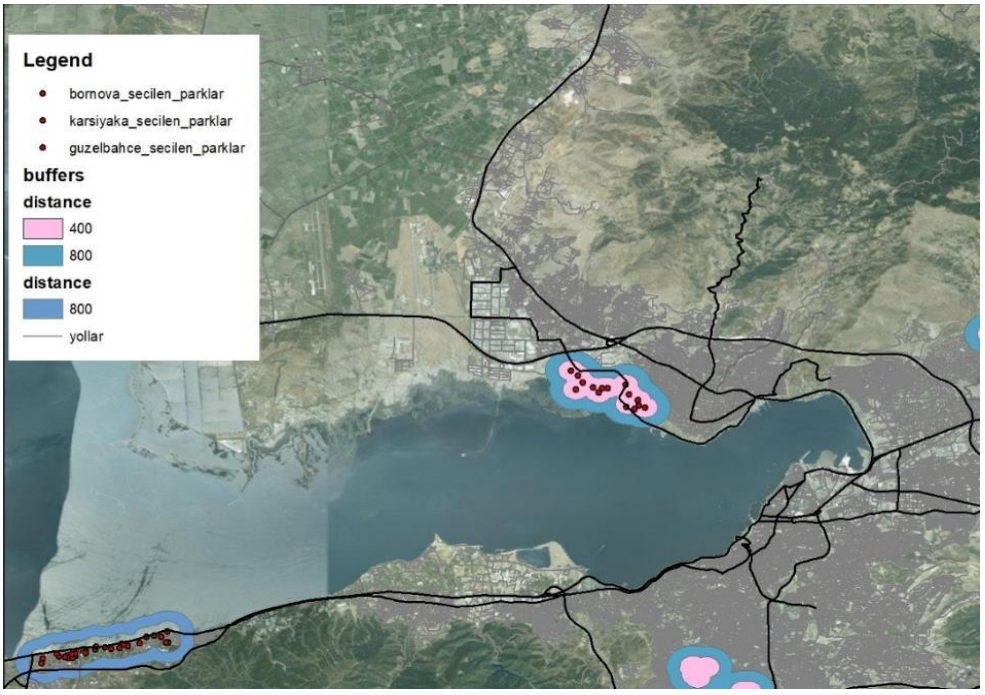


Fig. 1. Neighborhood districts with higher park area per capita

At this second round of observations at "highly used" parks, the observations in weekends and weekdays are detailed about age, gender and kind of park activities of park users. At the last stage, we chose 9 parks (3 in each district) that have relatively higher number of users and also different degrees of variety of land uses in their nearby area (residential, commercial, school, mosque etc.). In each park, we had

user surveys (total 2120) in park area and also interviews (total 339) with (almost) "none" users we met in park area, nearby public spaces and at home visits. These face-to-face studies are completed in September-October and February-June, the months with better (cooler) weather conditions for park use in Izmir.

FINDINGS

To evaluate the results of the study regarding these physical characteristics of parks, we followed three main steps which are "thematic grouping", "statistical analysis" and "descriptive analysis".

In the first step, we observed physical characteristics of parks and gathered them under a group of themes. These include walls and entrances of parks (Theme 1: accessibility/penetrability), seating options, illumination and shade (Theme 2: Basic furniture), playgrounds, sport fields, walkways (Theme 3: sport-play), café/ eatery, wc, car parking (Theme 4: comfort), park surface and plants with shade (Theme 5: landscape), trash, quality of furniture, graffiti, cameras-security (Theme 6: sense of maintenance-safety). Among all parks and "Highly-Used" parks, we looked at each of these physical characteristics both separately and also as part of each related theme that has a total score for each park.

A comparison of All of the observed parks and of "Highly Used" parks (respectively, 97 and 33 parks) according to their total scores of each theme (figure 1) shows that a high percentage of both groups of parks have "high" scores of accessibility/penetrability and also of green landscape features. The rest of parks have "average" score of green landscape, and there is no park with "poor" landscape. Similarly, majority of parks have "average" scores of maintenance-and-security. Most parks are with "average" and "poor" scores of Basic Furniture. Yet majority of parks' scores of Sport-and-Playground facilities and "comfort" (café, wc, car parking) are "poor."

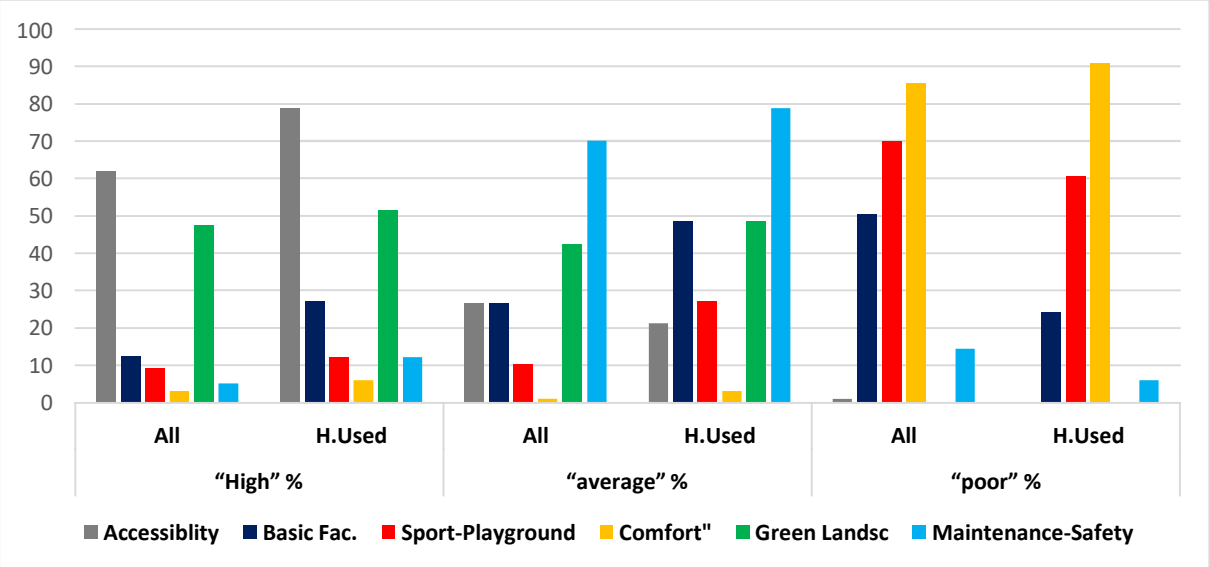


Fig. 2. Percentages of all and "highly used" parks according to their scores for each park services and facilities

Especially for the scores of Sport—Playground, this becomes interesting when we examined also social / user characteristics of parks.

At Step 2, we deployed statistical analysis (t-tests) between the distribution of physical characteristics and the number of average number of observed users at All and Highly-Used Parks, respectively at 4 and 8 field observations.

The results of t-tests for both All and also for "Highly Used" parks are detailed at Table 1. Since some physical characteristics are common among all Highly-Used parks (such as "no wall," "elements for shade, "enough illumination"), these are not included in statistical analysis with t-tests.

THEMES		**Variables**	**All Parks**	**Highly Used Parks**					
			Avrg user	**Avrg user**	**child**	**teen**	**old**	**woman**	**man**
Park Access		4+ entrance (open)							
		No Wall / Barrier	+	mutual					
		Entrances based on roads & references							
		In a crowded area	+		+				
		visible surrounding	+	mutual					
Variety of Park Amenities	Basic Amenities	Sufficient seating	+	+		+	+	+	+
		Picnic Tables							
		Shade Elements (Plants / Furniture)		mutual					
		Shaded areas?							
		Rain proofed area?							
		Water Feature				+			
		Illumination	+	mutual					
	Sports - Play	Playground	+		+				
		Sports Equipment	+			+			+
		Sports Area	+			+			
		Walking Trail							
	Comfort	Cafe	+						
		Toilet (Women/Men)				+			
		Car Park	+		+	+	-		
Park Landscape		Park landscape create shade	-	-	-			-	-
		Stepable green			+				
		50%+ soft surface	-						
Park Maintenance and Security		Well maintainance	+						
		No garbage		+			+		+
		No graffiti		+			+	+	+
		Safety feeling in the park	+	+	+				+
		Security Camera		+					
		Security Personnel	+			+			

Table 1. Results of t-tests between social and physical characteristics of parks

Results in Table 1 suggest that at All and Highly-Used parks, there are meaningful and positive relations between increasing number of users and certain physical characteristics of parks. For instance, those parks without physical boundaries such as fence or walls and with visual access to surrounding buildings and that are located in crowded surroundings tend to have more users. Moreover, out of basic facilities, especially "enough number" of sitting areas and also illumination of parks seem to attract more users almost at all age groups. Similarly, among all parks, those with well-maintained surface and furniture,

security guard and among "highly used" parks, those without graffiti and trash around seem to attract more and certain group of users. And parks with any facilities for sports (except walkways) and playground tend to get higher number of users, especially teens and children (and parents), as much as a parking area nearby.

However, at basics, the presence of natural and artificial shade and water elements do not have any statistically meaningful relations with number of users. Moreover, when parks have more landscape elements that have shade and a high percentage (more than 50%) of soft surface, they seem to have less users among both women and men. Only parks with more stepables seem to have more children.

This makes us wonder about the co-presence of landscape elements (here, especially shade) and elements of Sport-Playground and of Basic Furniture that seem to relate with more users. As shown in Figure 3, compared to the rest, more Highly-Used Parks have playground, "enough number" of seats and tables and also stepable green surface and shade (either by greenery or by artificial elements or by buildings etc.).

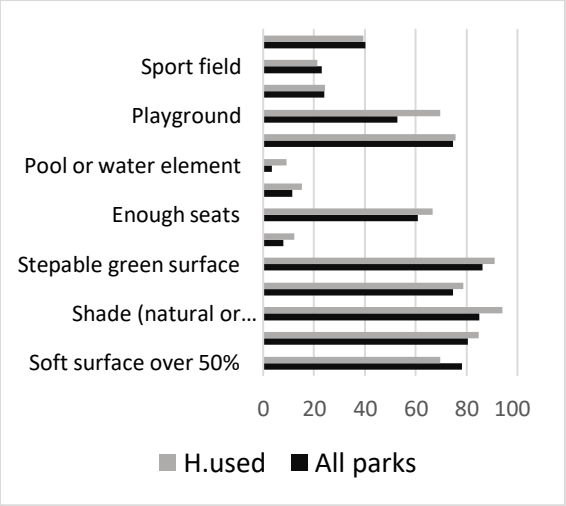


Fig. 3: Distribution of each sport-playground facilities and each landscape elements among All and Highly Used Parks

Yet this descriptive comparison does not show neither the co-presence of these elements in the same parks nor their togetherness in park design to provide thermal comfort for users. Another statistical analysis (Pearson test) between each themes for parks' physical characteristics help us to see such co-presence at parks (Table 2).

	Landscape	Basics	Sports-Play	Maint.-Sec.	Park Area m^2
Landscape	1	0,298988	0,204843	-0,0524	0,189045
Basics	0,298988	1	0,51029	0,470931	0,328515
Sport-Play	0,204843	0,51029	1	0,310206	0,247932
Maintenance-Security	-0,0524	0,470931	0,310206	1	0,147597
Size of Park Area	0,189045	0,328515	0,247932	0,147597	1

Table 2. How the Landscape theme relate to other physical characteristics of parks

As there are higher score of Sports-Playground, the score for Basic Furniture too increase significantly and so the score of Landscape but slightly. The score of Landscape relates positively to the score of Basic furniture, but interestingly it has no relationship with either Maintenance or size of the park area.

Moreover, the Pearson test between each elements of the themes of Sports-Playground and of Landscape detail the co-presence or clusters of certain physical characteristics across the parks at this study. Accordingly, there is a core cluster with benches, playground, sport tools, sport field and walkway. To this cluster, sometimes there are additional characteristics, such as enough night time lighting or stepable green surface and tables or night time lighting, shield for rain, bigger park area or night lighting and stepables.

On the other hand, there is no cluster with landscape elements: "Shade" seem to relate only to the shade by greenery or by artificial elements, but not any functions. There is another correlation among stepables, illumination, playground, walkways. But also interestingly there is negative correlation between soft surface and number of benches. In sum, the elements of Landscape (especially "shade") in the parks at this study do not correlate with functional elements.

At Step 3, we realized descriptive analysis according to the results of surveys with 2127 park users and interviews with 339 residents who are rare or none-users. Based on the results of descriptive analysis, most used parts of parksa are calm seating areas (44%), playgrounds (19%), walking trails (13%), sports areas (8%). However, these results are likely to change according to regions, gender and age.
As we analyze feeling of thermal comfort in parks we see that parks are mostly used during early evening (34%), afternoon (25%) and noon (16%). The reason to choose these hours is based mostly on hot weather conditions (28%). There are no specific time periods that users don't want to use parks (64%). Among rest of the participants, night time (42%) and noon time (30%) is not preferred due to hot weather conditions. Participants who stated weather as the reasons for limiting the park use are women (63%) and men (56%) in Güzelbahçe, and (21%) in Bornova (Figure 4).

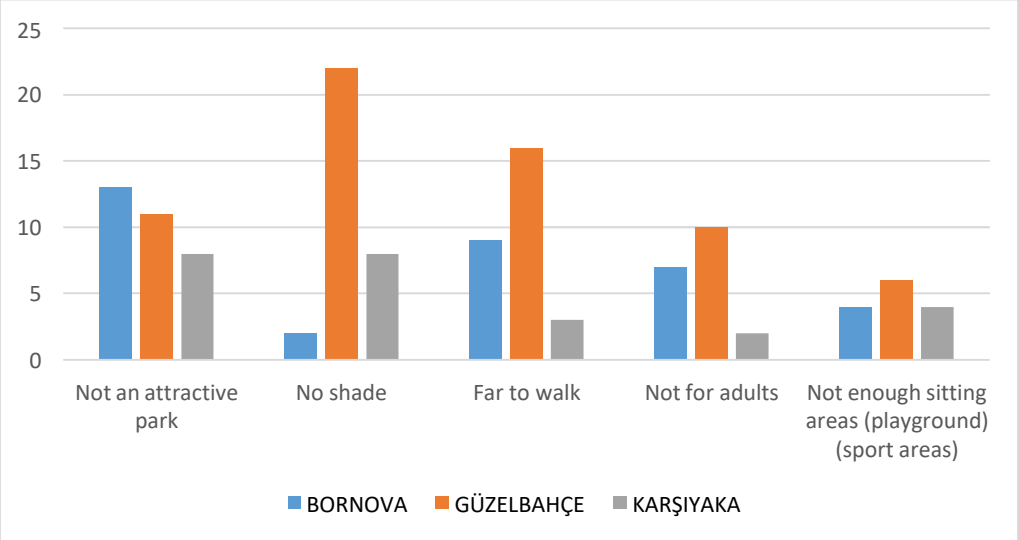


Fig. 4: Top 5 Reasons for NOT using that Park due to that park's physical characteristics (Total 9 Parks, Regional differences)

The reasons for lack of comfort in parks vary according to region, gender and age of participants. Mostly in Güzelbahçe lack of thermal comfort seem to be a concern (with higher number of non-working women who use parks for playgrounds). Even among those who find that park as comfortable for all, there are those suggesting for more "shade" with greenery especially with benches around playground.

Results indicate that mostly there is a concern regarding thermal comfort of parks in Güzelbahçe. This result is especially significant since there is a higher number of women who are not-working and visiting playground more often. Even among those who find park as comfortable for all, there are those suggesting for more "shade" with greenery especially with benches and playground. For instance in Kardeş Şehir Flörsheim Parkı, survey participants mentions their concerns as such:

"There should be more shade and more green area in the park"

"The number of shady area should be increased. There can be a pergola"

"Shady areas can be increased"

"We can't come to park for the playground any time we want during summer time as there is no shade around playground"

"There is no shady area for children while they play"



Fig. 5: Kardeş Şehir Flörsheim Parkı Sun Path Analysis

In Hasan Bakıcı Parkı in Güzelbahçe, participants also state similar concerns. These concerns are mostly stated by playground users. Although they are satisfied with the existence of playground, thermal comfort is a significant concern for users.

"It is good that there is a playground for children. Park is located in a crowded area and it is comfortable. We use it"

"It is under the bare sun, there is no sufficient number of trees so there is no shade"

" There needs to be a shady area. Playground needs to be under shade."



Fig. 6: Hasan Bakıcı Parkı Sun Path Analysis

Whereas in AA park or Lale Park, which are those parks with more facilities, there is less concern regarding thermal comfort.

" The park is suitable for those who wants to exercise"

"We can watch basketball games comfortably"

"There needs to be more green space and more playground"

"There can be more green"



Fig. 7: AA Parkı Sun Path Analysis

Similarly, In I love Bornova Park there is almost no concern regarding thermal comfort as it is under shade coming to the park from building on the south side of the park.

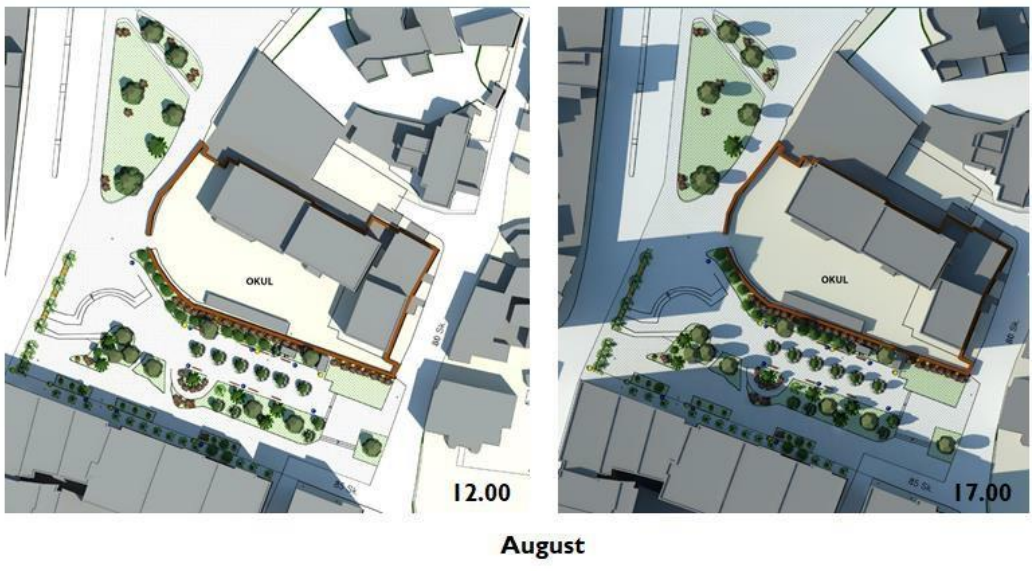


Fig. 8: I Love Bornova Parkı Sun Path Analysis

In Salih Evkuran – Engelliler Parkı there is also less complaints regarding thermal comfort as there is wider space that is suitable for more active uses and people come here mostly for strolling not for sitting.

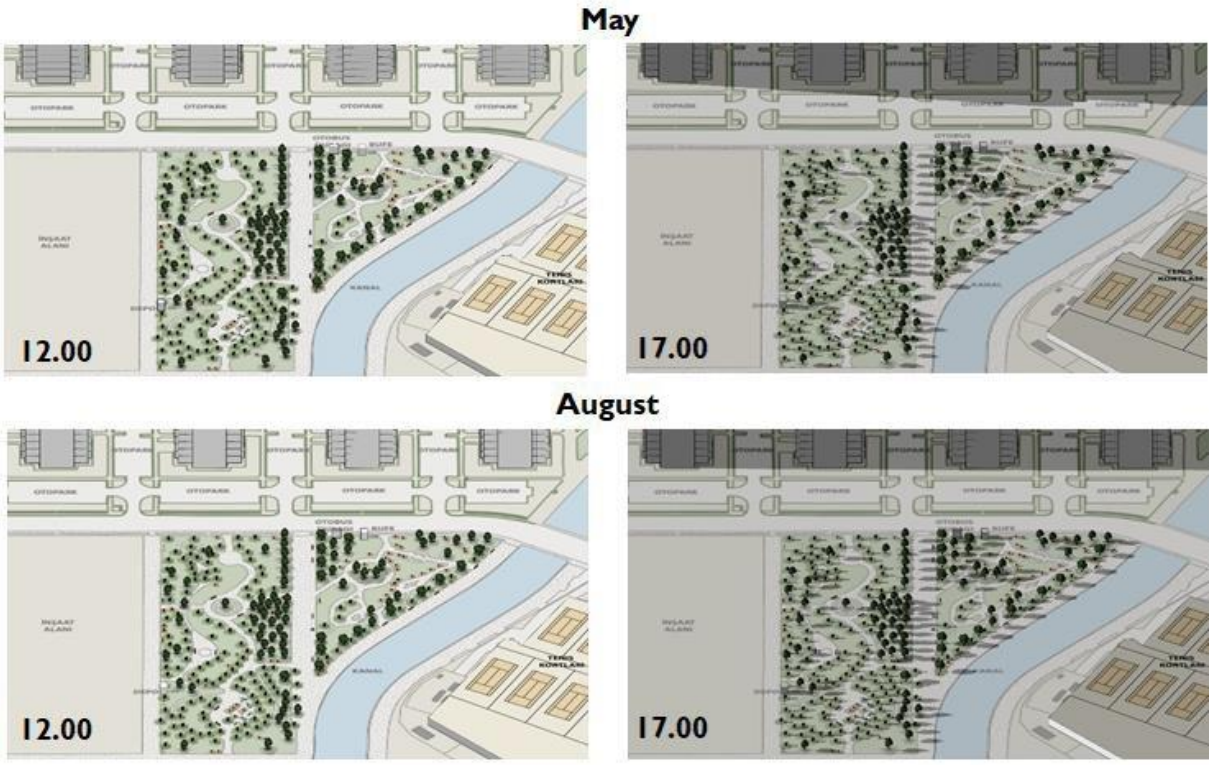


Fig. 9: Salih Evkuran - Engelliler Parkı Sun Path Analysis

CONCLUSION

Results indicate that especially sedentary activities (resting, waiting for child's play etc.) requires "shade". On the other hand, those coming to parks for more active activities such as sport or exercise are not bothered by lack of shade.

Most of the time park users are well aware of advantages and disadvantages of each park and they tend to admit what is missing in which park and select different parks for different activities.

Lack of shade excludes especially those who use parks for playgrounds (both children and their parents) and for watching sports games.

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REFERENCES

[1] Whyte, (1988): City: Rediscovering the Center. New York: Doubleday.
[2] Carr, S., Francis, M., Rivlin, L. G. & Stone, A. M. (1992). Public Space. Cambridge: Cambridge University Press.
[3] Lai, D., Liu, W., Gan, T., Liu, K., Chen, Q., (2009). A review of mitigating strategies to improve the thermal environment and thermal comfort in urban outdoor spaces. Science of The Total Environment, Vol. 661, 15, p. 337-353.
[4] J. Gehl. (1971). Life between buildings: Using public space. Danish Architecture Press, Distributed by Island Press.

[5] Nikolopoulou, M. and Lykoudis, S. (2006) Thermal Comfort in Outdoor Urban Spaces: Analysis across Different European Countries. Building and Environment, 41, 1455-1470.

International Journal of Landscape Architecture Research
3(2): 151-161, 2019

[6] Nikolopoulou, M. & Baker, N. & Steemers, K. (2001). Thermal comfort in outdoor urban spaces: Understanding the Human parameter. Solar Energy. 70. 227-235.
[7] Chen, Liang & Ng, Edward. (2012). Outdoor thermal comfort and outdoor activities: A review of research in the past decade. Cities. 29.
[8] Nikolopouloua, M. & Steemers, K. (2003). Thermal comfort and psychological adaptation as a guide for designing urban spaces. Energy and Buildings. Vol. 35, 1, p. 95-101.
[9] Thorsson, S., Lindqvist, M. & Lindqvist, S. (2004). International Journal of Biometeorol. 48: 149.