

USER PERCEPTION OF SOUNDSCAPES OF URBAN PARKS IN ANKARA

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Abstract

The concept of soundscape has recently gained attention of planning and design disciplines where focus is generally on the visual, rather than the acoustic, aspect. On the other hand, sound is an important element of a place which affects individual's perception and understanding of an environment. Urban acoustic environments are complex and involve a broad diversity of sound resources. Evaluation of urban soundscapes is crucial not only for noise mitigation but also to assess acoustic comfort which is integral to overall environmental quality.

This study presents user-perceived acoustic comfort and characteristics of urban parks in Ankara, Turkey. The research was carried out through face-to-face questionnaire surveys and sound level measurements in five urban parks (Altınpark, Botanik Park, Gençlik Park, Güvenpark and Segmenler Park) of Ankara between June and September 2011. The parks were chosen to represent different physical attributes and users with varying socioeconomic backgrounds. The questionnaire form consisted of 24 questions relating to demographic characteristics, park use, sound perception and sound preferences. A total of 200 users participated in the survey. Data were analyzed using SPSS version 15.0. Sound level measurements were conducted during questionnaire surveys for 1 minute. For further assessment another series of sound level measurements were conducted at 27 locations in five parks twice for a week (one weekday and one day on the weekend and twice between 09:00-12:00 and 17:00-20:00).

No statistical significance was found between acoustic comfort evaluations and gender, age and educational background. Natural sounds were found to be preferred to artificial sounds. Furthermore, user identifications of general soundscapes of the urban parks seem to have a strong relationship to physical attributes of the parks and visitor expectations. The results of this study are expected to raise awareness on the role of soundscape in context of urban environmental quality amongst planners and designers and assist them in soundscape planning and design.

1. Introduction

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Noise pollution is a growing environmental problem, especially in urban environments, which might cause serious health effects on living organisms. Governments and global institutions have been developing measures to prevent noise pollution and to reduce noise levels. However, reducing noise levels does not always lead to more pleasant environments (Zhang and Kang, 2007; Cain et al., 2011) or increase life quality. In his book “Tuning of the World” (1977, p.4), Schafer points out that noise abatement is a negative approach and we need to seek positive ways to study environmental acoustics in order to understand which sounds must be eliminated from our surroundings. In fact, it is now well known that sound quality cannot be determined by evaluating sound merely in physical terms and ignoring psychological dimension (Raimbault and Dubois, 2005). On the other hand, in soundscape studies both physiological and psychological dimensions are taken into account and they aim to understand the relationship between people and their acoustic environment by joining together physical and psychological aspects.

Salvador (2010) defines a soundscape as “*a temporal and typological organization of sound objects, related to a certain geo-cultural context, in relation to which a listener can apply a spatial and semiotic transformation*”. Since the concept of soundscape was first introduced by R.Murray Schafer in late 1960s, it has become a research area for many disciplines, acoustics in particular. However, it is very recent that it has gained attention by planning and design disciplines. Generally planning and design goals do not involve acoustic dimension of the environment, except noise control. This is mainly because sound is generally perceived and considered as a negative element within an environment and often misused as a synonym for “noise”.

There are many inputs and outputs in urban environments due to the high variety of human activity. As a result, designing and management of urban environments are considerably complex in many aspects. These environments are constantly moulded by the spatial, and both social and cultural characteristics of the community. Consequently, the soundscape of an urban environment becomes fairly complex as well, due to physical, psychological and social factors (Cain et al., 2011). But how are people and their quality of life affected by the acoustic environment of an urban surrounding? In order to integrate sound as a resource for urban design and planning, first we need to understand how people perceive their sonic environments and how they react to them. There is a perceptual dimension of a soundscape which is influenced by both explicit attributes of the physical place and implicit attributes of social and cultural factors (Yu and Kang, 2010). Perception is an active process where perceiver selects information from its environment through senses; then organizes and interprets it. Although vision is the dominant sense for human’s perception of his environment, sound –as second most dominant sense- also plays an important role in sensing and understanding our environments. Preference studies are common in environmental psychology to evaluate people’s perception of their surroundings. Hence, evaluating sound preference is very important in order to determine the quality of soundscape in a specific space (Yu and Kang, 2010).

Urban open spaces contribute to overall quality of an urban environment in many aspects (aesthetics, ecology, leisure and recreation etc.). They are comprised of natural and cultural features which provide urban citizens with opportunities to refresh and enjoy themselves within the fast paced urban life. Although most soundscape studies focus on relatively large rural and urban areas, there is a limited number of research on urban open public spaces (Kang and Zhang, 2010; Yu and Kang, 2010). Similar to other design and planning disciplines, landscape design and planning have traditionally focused on mitigation of unwanted noise and its effects so far. McHarg (1969) defined landscape planning process as the overlay and synthesis of land data in his famous work “Design with Nature”. He also included sound data as a resource for noise. However, sound is more than an element that generates noise but also a potential resource for the designer and planner. On the other hand, while digital visualizing tools allow us to see how a proposed project might actually look like, it is much more difficult to contemplate or visualize possible outcome in terms of acoustic environment. Hence, there is a certain need for theoretical background and research methodologies for evaluating sound in landscape design and planning (Hedforde, 2003).

The concept of “soundscape” (*işitsel peyzaj* in Turkish) is very little known in Turkey. The first soundscape research has been conducted by Özçevik (ongoing PhD dissertation) on soundscape in covered spaces (Özçevik and Can, 2011). However, there wasn't any soundscape research in urban open spaces; furthermore researchers were unfamiliar with the concept and its context. In 2010, our proposed research project titled “Evaluation of Soundscape Perception and User Preferences in Urban Parks in Frame of Life Quality: Case Study Ankara – Turkey” was accepted by TÜBİTAK (The Scientific and Technological research Council of Turkey) within the COST (European Cooperation in Science and Technology) Action “Soundscape of European Cities and Landscapes” (TD0804). In this paper, preliminary results of the project are presented. The research project aims to:

- integrate soundscape concept with urban parks,
- provide data on subjective sound perception and soundscape overall using qualitative and quantitative measurement and assessment techniques, and
- interpret urban parks' soundscape, acoustic comfort and life quality in the context of perception and preferences.

2. Materials and Methodology

2.1. Spatial Data

In this study, 5 urban parks (namely Altınpark, Botanik Park, Gençlik Park, Güvenpark and Seğmenler Park) which are located on the north-south axis of Ankara city have been selected (Figure 1). The selection criteria are; (i) parks that represent different types of parks in the city, (ii) parks that are preferred by users, (iii) high diversity of activities, and (iv) high diversity of different sound resources. The characteristic features of the selected parks are shown in Table 1.

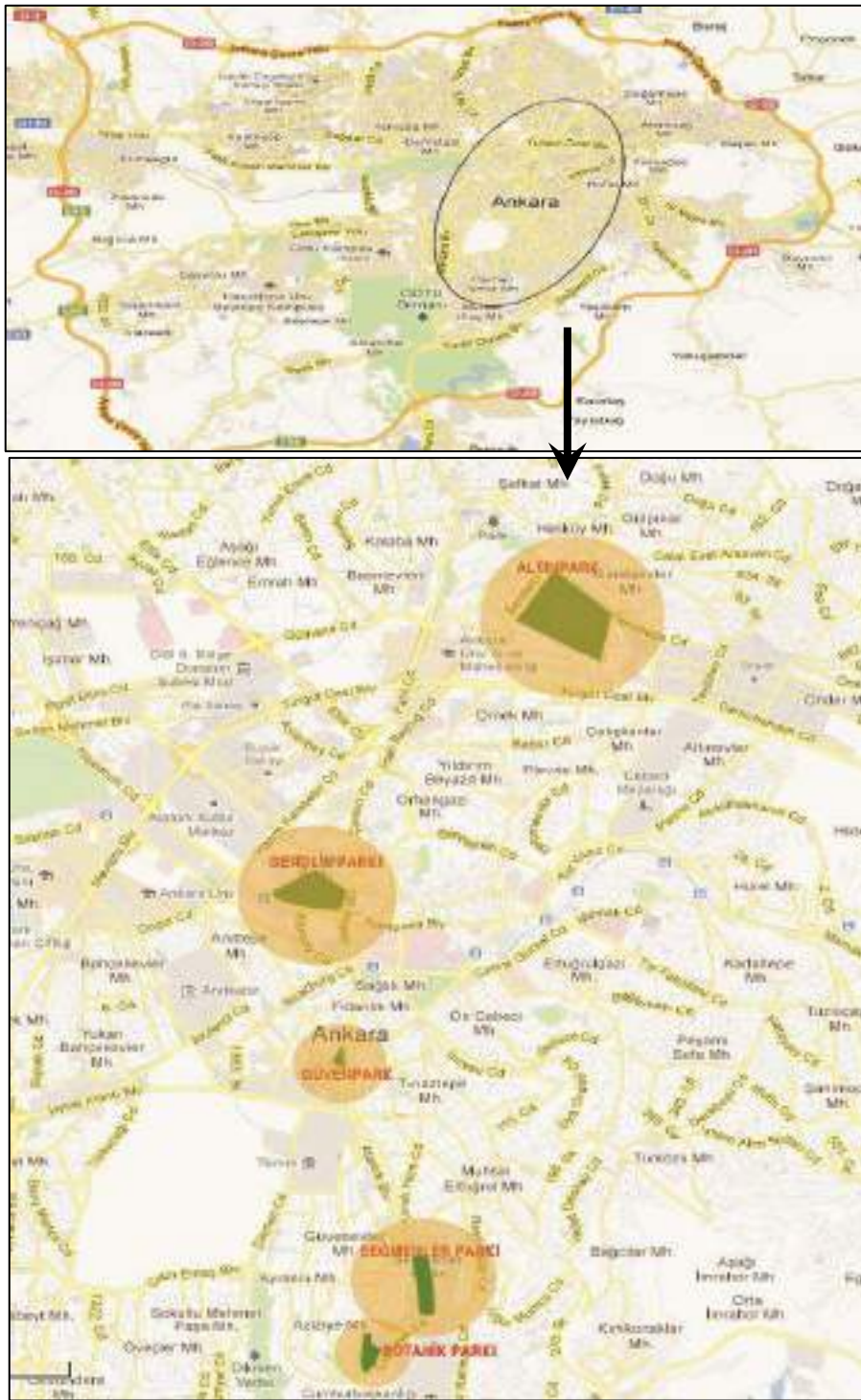







Figure 1. Selected Parks for The Research

Table 1. Characteristics of The Selected Parks

PARK	Size (m ²)	Main Features and Facilities	Established
 Altınpark (Google Maps, 2012)	640.000	Green areas Water surfaces Exhibition hall Amphitheatre Playgrounds Cafés Restaurants Rollerblade and skate ring	1993
 Botanik Parkı(Google Maps, 2012)	63.085	Green areas Water surfaces Playground	1970
 Gençlik Park (Google Maps, 2012)	275.000	Green areas Water surfaces Cafés Fairground Playground Theatre complex Parking lots	1940 (Reopened in 2009 after revision of the master plan.)
 Güvenpark (Google Maps, 2012)	22.000	Green areas Water surfaces Playground Famous for Güven Monument	1936

		67.200	Green areas Water surfaces Amphitheatre Playground Café	1983
Seğmenler (Google Maps, 2012)				

2.2 Questionnaire Surveys

A questionnaire survey consisting of 24 questions has been prepared to investigate the user perception of soundscapes in urban parks. The questionnaire items are a mixture of open-ended, multiple choice and Likert type questions. The questionnaire forms have been divided into four sections: (i) demographic characteristics, (ii) park use pattern, (iii) satisfaction level of physical environment and (iv) sound perception and preferences. Between June and September 2011, questionnaires were administered to randomly selected 200 park users (40 at each park) face to face. The data have been evaluated using frequency analysis, factor analysis and chi-square test in SPSS version 15.0. One minute sound pressure level (SPL) measurements were also made during the interviews.

2.3 Field surveys

For further assessment of soundscape perception and preferences of users, another series of sound level measurements were conducted at 27 locations in five parks twice for a week (one weekday and one day on the weekend and twice between 09:00-12:00 and 17:00-20:00). SPL for each location was measured for 15 minutes in terms of L_{eq} values, with a sound level meter. The locations where the measurements took place have been selected to represent various user activities such as playgrounds, open air cafes, surrounding roads etc. Finally, the data have been transferred to the SoundPLAN® software in order to generate sound maps of the parks.

3. Results

Of 200 participants 62% were male and 38% female. Other personal and demographic characteristics of the participants are shown in Table 2. Most of the participants (80%) live in apartment buildings.

The results show that visiting parks on a daily basis is not common among the users. Most participants (25%) visit parks for a few times a week. They mostly (28%) spend 2 hours at most in a park. The parks are least used between hours 12 and 14. This might be due to the fact that the questionnaire surveys were conducted during

summer time when the temperature can be quite high during the day in Ankara. The highest temperature recorded during the questionnaire surveys was 37°C on 1st of August, 2011.

The participants were asked to identify the aspects of the parks which they were most and least satisfied with. The results for each park were shown in Table 3. General appearance and air quality are two significant aspects which the users are most satisfied with. On the other hand, most participants complained about the inadequate site furnishing and lack of variety of activities in the parks. None of the participants mentioned about acoustic environment quality within the parks. However, 31% of the participants stated that “silence and tranquility” was the first reason for their preference of visiting a park. The other significant motives include “to have contact with nature” (35%) and “transport accessibility” (20%).

Table 2. User Characteristics

User characteristics	Percent (%)
Age	
15-20	25
21-30	24
31-40	16
41-50	14
51-60	6
>60	15
Level of education	
Elementary	11
Secondary	13
High school	38
Higher education	36
Other	2
Employment	
Working	41
Student	25
Unemployed	6
Retired	18
No answer	10

Table 3. Users Satisfaction with The Parks

Park	Most satisfied with	Least satisfied with
Altınpark	General appearance (aesthetics)	Site furnishing
Botanik Park	Air quality	Children playgrounds
Gençlik Park	General appearance (aesthetics)	Function of activities
Güvenpark	Accesibility	Walking paths

Seğmenler Park	Air quality	Site furnishing
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Only 7% of the participants indicated that they were hard of hearing. On the other hand, 31% of the participants stated that they had sensitive hearing. Except Botanik Park and Seğmenler Park, participants defined the general sound level of the environment as “moderate” (Table 4). Although Güvenpark is located in the “core” of the city centre where vehicle traffic and pedestrian density are quite high, only 22% of users defined the sound level as high and 5% as very high. On the other hand Botanik Park and Seğmenler Park are located in a valley which provides a significant reduction in vehicle traffic noise from the main roads which surround both parks. Furthermore these parks have a dense vegetation cover, mainly a mixture of both deciduous and evergreen trees.

Table 4. Users’ Evaluation of Sound Levels of The Parks (%)

Park	Very low	Low	Moderate	High	Very high
Altınpark	10	31	54	5	-
Botanik Park	3	57	37	3	-
Gençlik Park	-	12	65	20	3
Güvenpark	2	5	66	22	5
Seğmenler Park	5	47	47	-	1

Acoustic comfort of the parks was evaluated as the satisfaction with perceived sound levels of the acoustic environment. In general, most of the participants (75%) were pleased about the sound level of the parks. However, while only 51% were pleased with Güvenpark’s ambient sound level, Botanik Park’s ambient sound level was found to be pleasant by 89% of its users. These results have been expected by the researchers because of the explanations given in the previous paragraph. Similarly, while Gençlik Park, where hard surface is dominant within the park’s landscape, was found pleasant by 67% of its users, more users in Altınpark (85%) and Seğmenler Park (82%), where vegetation cover is more dense, defined ambient sound level as pleasant. The sound level measurements during the questionnaire survey show that SPL varies between 48 dBA and 75 dBA for the interviewees who were pleased with the ambient sound levels. Therefore, it is not possible to draw a conclusion on the relationship between measured sound levels and satisfaction of ambient sound level.

The participants were then asked to identify which sounds they hear at that moment. The responses were a mixture of both natural and cultural sound types which were shown in Table 5. Although different activities in the parks generate different types of sound, the participants in all parks identified similar sound types.

Table 5. Sound Types Heard in The Parks

Altınpark	Botanik Park	Gençlik Park	Güvenpark	Seğmenler Park
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Bird	Bird	Bird	Bird	Bird
Water	Water	Water	Water	Water
People	People	People	People	People
Plane	Plane	Vehicle traffic	Vehicle traffic	Plane
Vehicle traffic	Vehicle traffic	Children	Children	Vehicle traffic
Children	Children	Music	Music	Children
Music	Plants	Wind	Plants	Plants
Plants	Other animals	Construction	Screaming	Other animals
Other animals	Wind	Screaming	Adhan	Wind
Wind	Construction			Construction
Phaeton				

In all parks bird and water sounds were defined as pleasant. The participants stated that the most annoying sound types were screaming, vehicle traffic and people talking on mobile phones. Furthermore, the participants perceived the vehicle traffic noise as the most dominant sound type in the parks except in Gençlik Park. In Gençlik Park screaming was the perceived most dominant sound type. This might be as a result of the fairground which is located within the park. However, it is no surprise that people preferred natural sound types over artificial sounds. Various research also showed that people tend to prefer natural sounds more (Carles, Barrio and de Lucio, 1999; Reiter, 2004; Kang and Zhang, 2010).

In the final part of the questionnaire, participants were given 17 bipolar adjective scales and asked to define how they felt about the acoustic environment. The adjective list was given in Table 6.

Table 6. Adjective List for Acoustic Environment Evaluation

Acoustic aspects	Adjectives
Sound power	Quiet-loud
Spatial organization	Organized-disorganized
Clarity	Clear-unclear
Diversity	Similar-diverse
Activity	Calm-lively Slow-fast Monotonous-varied
Rhythm	Orderly-disorderly
Tone	Soft-hard
Sound assessment	Interesting-uninteresting Pleasant-unpleasant Meaningful-meaningless Relaxing- annoying

Happy-sad
Emotional-apatetic

Factor analysis was made for all the data using varimax rotated principal component analysis. Four factors (with Eigenvalue > 1) were determined and the cumulative variance was 59%. Kang and Zhang (2010) found a similar value (53%) in their research and suggested that such low values might be due to the significant variations in number and type of the sound sources in urban public spaces. Factor 1 (%32) was found to be associated with power, activity and tone of sound, as well as with pleasantness, interestingness, and relaxation. Sound power was also found to be a significant factor in satisfaction of ambient sound levels ($p < 0.05$). Participants who were “very pleased” and “pleased” about the acoustic environment also evaluated the ambient as “quiet”. Likewise, participants who found ambient sound level as “annoying”, defined the acoustic environment as “very noisy”. Factor 2 (10%) was related to sound activity and Factor 3 (10%) to spatial organization of the sound. Finally Factor 4 (7%) was associated with sound diversity.

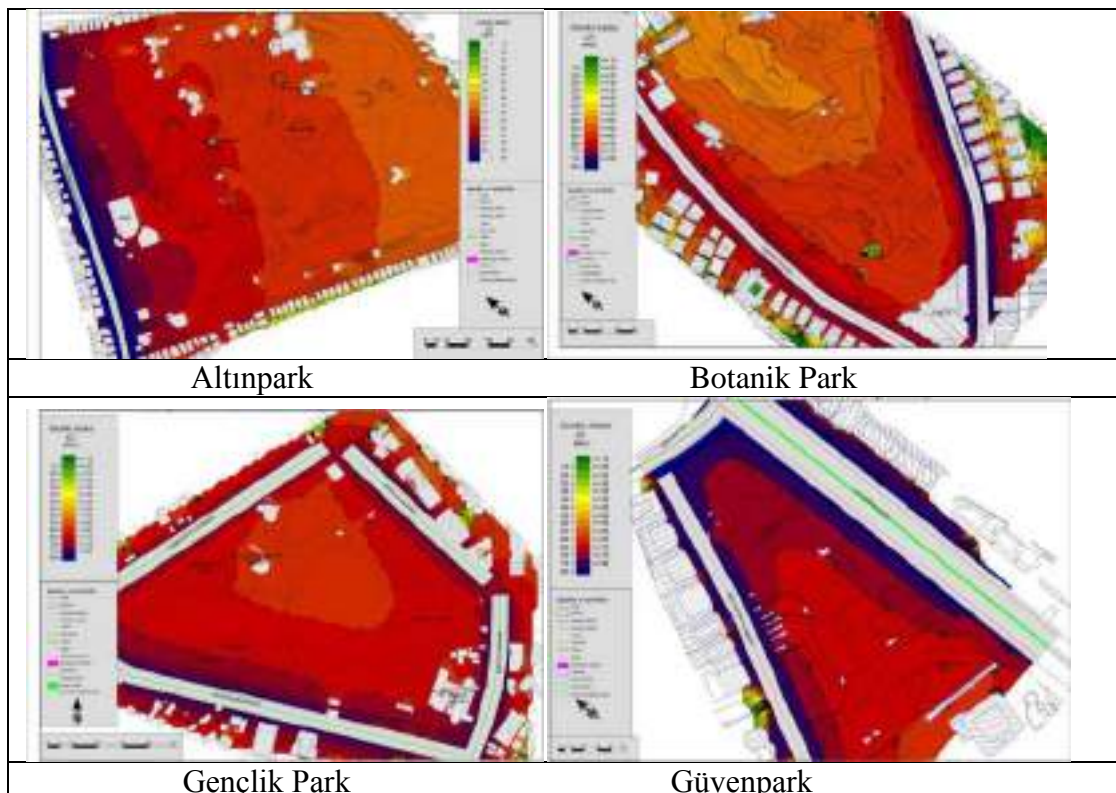
The participants were unfamiliar with the concept of soundscape and they had difficulties in understanding the last question and expressing their perception of the acoustic environment. However, in the reliability analysis Cronbach’s alpha was found higher than the expected; 0.7 for Botanik Park and Gençlik Park, and 0.8 for other parks. The significant characteristics of the soundscapes perceived by the participants for each park are presented in Table 7.

Table7. User Perception of The Soundscapes

Park	Characteristics of the soundscape
Altınpark	Diverse Neither quiet nor loud Neither happy nor sad Neither emotional nor apathetic
Botanik Park	Quiet Calm Diverse Soft Neither happy nor sad Neither emotional nor apathetic
Gençlik Park	Neither happy nor sad Neither emotional nor apathetic
Güvenpark	Very diverse Neither happy nor sad Neither emotional nor apathetic
Seğmenler park	Neither emotional nor apathetic Quiet Calm Neither happy nor sad Soft

There was no correlation found between demographic characteristics (gender, age, and level of education) and sound level evaluations or satisfaction with ambient sound levels. Similarly, there was no statistical significance found ($p>0.05$) between participants with sensitive hearing and others in ambient sound level satisfaction or sound level evaluations. However, preference for different types of sounds was found to be related to age. While younger participants tend to prefer rather cultural sounds such as music, middle aged and elder participants preferred natural sounds such as bird and water.

The sound maps of the parks which were created by using sound level measurements show that there is an obvious influence of vehicle traffic noise nearby (Figure 2). The SPL decreases as the distance from roads increases. Although a majority of participants in Altınpark, Gençlik Park and Güvenpark evaluated the ambient sound level as “moderate”, it can be seen that actual sound levels show difference from one park to another. Especially SPL is quite higher in Güvenpark than the other parks. Hence we can assume that visitor expectations from the environment can also affect user judgments. As mentioned before, Güvenpark is located in an area where vehicle and pedestrian traffic is heaviest. Therefore, people might already expect higher ambient sound level and perceive it as “moderate”.



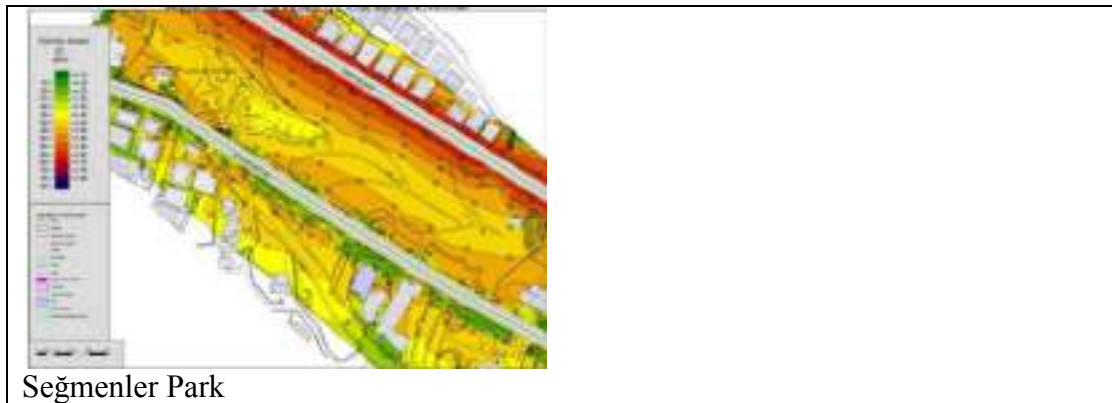


Figure 2. Sound Maps (Highest sound levels are shown in navy while lowest shown in green)

Furthermore, the ambient sound level of Seğmenler Park defined as “moderate” and “low” by the same percent of users. Yet, sound maps show that the SPL is much lower in Seğmenler Park compared to other parks. Besides, despite the fact that factor analysis revealed that sound power is an influencing factor; quietness is not always associated with high levels of user satisfaction. Although Seğmenler Park has the lowest SPL, it was ranked third in terms of satisfaction from the ambient sound levels. It can also be suggested that overall satisfaction from urban parks has an influence on ambient sound level satisfaction. Research data show that as the satisfaction level with the physical environment increases, users tend to perceive soundscapes in the parks more pleasant.

It is also observed that physical characteristics of the parks play a significant role in user evaluations of soundscapes. In this study, topography and vegetation cover are found to be the two main factors that affect user perceptions and actual sound levels. Ambient sound levels of the parks with most vegetation cover (Botanik Park, Altınpark and Seğmenler Park) were most pleasant for their visitors. Topography also helps with reducing sound levels, especially in Seğmenler Park and Botanik Park which are located within the valleys. However, it should be noted that this paper only presents the analysis of the data which was obtained in summer time. Since climatic conditions were quite steady during the field work and questionnaire surveys, it is not possible to interpret the role of climatic variables.

4. Conclusions

In this paper, preliminary results of research on user soundscape perception of Ankara’s urban parks have been presented. Physical environment characteristics and user expectations have been found to be influencing on the visitor perception of urban parks’ soundscapes in terms of acoustic comfort evaluation. People tend to tolerate higher levels of sound if they are content with their physical surrounding or if they already expect an environment to be noisy. Furthermore the quietest environment is not necessarily the most preferred.

People visit urban green spaces mainly for having contact with nature. It is also a well known fact that people prefer environments with natural contents such as all forms of vegetation and water. This study has concluded that they also tend to prefer natural sounds over artificial sounds. Hence, creating places with natural elements in urban open spaces might help to mitigate uncomfortable effects of unwanted or least preferred sounds in an urban environment such as traffic sound. The data has shown that there are a wide range of sound types perceived by users in an urban park. Designers should realize that diversity of activities in urban open space is directly linked to the diversity of the soundscape. On the other hand, existence of unpleasant sound types does not necessarily have adverse effect on overall satisfaction with the soundscape. Meanwhile it should also be noted that silence and tranquility are amongst the driving motives for people visiting urban parks where sound levels are relatively lower than other urban areas.

In an era of increased environmental awareness, open and green public spaces play a significant role in developing sustainable societies. Urban parks are important assets that contribute to the quality of life in many aspects. They provide community and urban environment with ecological, psychological, sociological and various health benefits. As planners and designers, we should more focus on how people perceive and what they expect from their physical surroundings. Furthermore, the European Landscape Convention emphasizes the concept of “landscape quality” and acknowledges that “*landscape is a key element of individual and social well-being*” (Council of Europe, 2000). Sound, in this sense, is an important resource in planning and design which has been neglected so far. Hopefully, more research on urban open space soundscapes will help professionals and authorities to include sound as a key element in their projects and understand sound can be a vital and guiding resource in open and green space design. We expect the outcomes of this project to contribute to the field of urban design when the research is completed.

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