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A COMPARATIVE STUDY ON THE ROLE OF SOUNDSCAPE PERCEPTION IN PLACE ATTACHMENT OF GRADUATE STUDENT HOUSING

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Abstract

Place attachment reflects the emotional and functional bonds individuals develop with their living environments, playing a critical role in well-being and residential satisfaction. While previous research has extensively examined place attachment through the dimensions of place dependence and place identity, the role of soundscape in shaping these bonds remains underexplored, particularly within residential academic settings. Graduate student housing represents a distinctive living environment where academic routines, social interaction, and environmental conditions intersect, making it a valuable context for soundscape-related inquiry. This study examines how soundscape perception varies across different spatial configurations in graduate dormitories and how these perceptions relate to residents' place attachment. The research is conducted at Bilkent University, where graduate housing units are located in three contrasting spatial conditions: a dormitory adjacent to a sports field, an elevated and acoustically exposed building, and a newly constructed courtyard-type complex with reflective spatial characteristics. These configurations generate diverse acoustic environments shaped by varying external and internal sound sources. Based on the ISO/TS 12913-2 soundscape assessment framework, the study employed a questionnaire incorporating Method A and a Place Attachment scale, together with in-situ sound level measurements (LAeq). A total of 57 graduate students participated in the study. The findings revealed statistically significant associations between sound-

scape perception and place attachment, demonstrating that positive residential soundscapes emerge from the interaction between acoustic conditions and spatial context, ultimately strengthening students' emotional attachment to campus housing.

Keywords: *sound environment, place attachment, residential soundscape, perception*

1. Introduction

The term "place" has been used in geography for many years; however, during the 1970s, it started to be viewed as more than just a physical location. Researchers began to describe place as a meaningful environment associated with personal meanings and emotional connections, combining location, locale, and sense of place [1]. [2] introduced place identity as a dimension of self-identity developed through interactions with the physical environment, including emotions, values, and behavioral tendencies. Expanding this perspective, [3] emphasized that place identity also functions as a distinguishing characteristic that differentiates one place from another through meanings and perceptions attributed by both residents and outsiders. As individuals develop meanings and emotional connections through their interactions with the environment, residential settings and their environmental qualities become important factors in shaping place identity and attachment. Housing preferences are shaped by a combination of physical, environmental, social, and functional characteristics. Previous studies have shown that residential choice is influenced by neighbourhood quality, accessibility, environmental attributes, proximity to services, and perceived residential quality [4]–[6].

The literature review examines the various interpretations of place attachment as understood within fields such as social psychology, environmental psychology,

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and community sociology [7]. One of the most recognized and influential concepts in the study of place attachment is the two-dimensional theory proposed in 1989, encompassing the essential dimensions of place dependence and place identity [8], [9]. [10] introduced a model that synthesizes numerous aspects of place attachment and emphasizes both biophysical elements, such as personal connections (place identity and place dependence) and environmental ties (emotional affinity and nature bonding), as well as socio-cultural factors, particularly community-related aspects including neighborhood attachment and belongingness. While place attachment is the emotional and cognitive bond individuals establish with specific locations, influenced by subjective perceptions and satisfaction [11], place dependence relates to practical reliance on a location's attributes, while place identity reflects emotional and symbolic connections [12]. In soundscape research, context refers to the non-acoustic factors that influence how people perceive, experience, and interpret acoustic environments. These factors include the physical setting, landscape and architectural characteristics, aesthetic qualities, socio-cultural conditions, activities, time of day, season, weather conditions, and individual characteristics. Rather than considering sound as an isolated physical phenomenon, the soundscape approach adopts a holistic perspective in which perceptual outcomes emerge through the interaction between acoustic properties and contextual factors [13]–[15].

Recent soundscape studies have investigated indoor soundscapes across healthcare, educational, and office environments, with particular attention to perceptual evaluation, audio-visual interactions, restorative effects, and indoor soundscape assessment methods (e.g., [16]–[23]). Nevertheless, the relationship between soundscape perception and place attachment in university student housing remains insufficiently explored.

University student housing represents a distinctive residential setting where academic routines, social interactions, and daily living activities intersect, making it a particularly valuable context for investigating the relationship between soundscape perception and place attachment. Therefore, this study aims to address three fundamental research questions:

- 1) How do students perceive the soundscape in university campus housing environments?
- 2) What is the relationship between soundscape perception and students' place attachment to their living environment?
- 3) To what extent does the soundscape contribute to the development of place attachment among students living on campus?

By addressing these questions, this study aims to contribute to the growing body of research examining the relationship between soundscape perception and place attachment within university housing environments.

2. Method

2.1. Design of the Study and Site

The study was conducted in four graduate student housing buildings on the Bilkent University campus. These buildings are located in different areas of the campus and differ in terms of their sound environments and spatial configurations. The first building is located near the American football field and close to the second exit of the main campus. The flats are designed with three separate rooms, one for each student, along with a shared kitchen and a bathroom. The second building is situated at the highest point of the main campus and accommodates both graduate and undergraduate students. The rooms are arranged along a shared corridor, with access to a common kitchen and bathroom. Each room is assigned to a single student. The third and fourth buildings face each other and share a central atrium. These buildings are designed with en-suite rooms, one for each graduate student, and include shared corridors and common spaces. They are located near wooded areas and Bilkent Lake. These buildings were selected for the study due to their diverse spatial characteristics, building layouts, and sound environments.



Figure 1: Locations of the selected housing buildings and representative photographs of the rooms

2.2. Participants

Participants were selected using convenience sampling. A total of 57 participants from all housing types took part in the study. The first section of the questionnaire collected participants' demographic information, including age, gender, educational level, current campus residence, and the length of time they had been living in their current residence. The sample consisted of 39 females and 18 males, with ages ranging from 25 to 35 years ($M = 28.21$, $SD = 2.86$ years). The questionnaire took approximately 10 minutes to complete per participant.

2.3. Procedure

Ethical approval was obtained from the Bilkent University Human Research Ethics Committee (Decision

No. İAEK_2026_04_14_02; Application No. 845) before the commencement of the study, and all participants provided informed consent prior to participation. Graduate students residing in the selected on-campus housing facilities at Bilkent University were recruited on a voluntary basis. Participants were informed about the purpose of the study, the confidentiality of their responses, and their right to withdraw from the study at any stage without any consequences. Residents accessed the online questionnaire by scanning a QR code. After reading the participant information and providing informed consent, participants completed an online questionnaire administered in accordance with Method A of ISO/TS 12913-2:2018. The questionnaire included demographic information, soundscape-related assessments, and place attachment measures. A detailed description of the questionnaire is provided in the following section. In-situ acoustic measurements were also conducted to record the equivalent continuous sound pressure level (LAeq) under the existing environmental conditions. Throughout the research process, ethical principles were strictly observed. Participant confidentiality was maintained, all personal identifiers were removed from the dataset, and each participant was assigned a unique identification code to ensure anonymity during data analysis.

2.4. Data Collection and Analysis

Data were collected through a structured questionnaire administered to graduate students residing in the selected on-campus housing facilities at Bilkent University. The questionnaire was designed to investigate participants' perceptions of the residential acoustic environment and their attachment to place. As illustrated in Fig. 2, it consisted of three sections: demographic information, soundscape assessment based on the ISO/TS 12913-2 Method A questionnaire, and multidimensional place attachment measures.

The first section collected demographic information and housing characteristics. The second section assessed participants' perceptions of the acoustic environment, including perceived sound sources, perceived affective quality, assessment of the surrounding sound environment, and the appropriateness of the surrounding sound environment. The third section comprised a multidimensional place attachment scale based on the framework proposed by Raymond et al. [8]. The scale was adapted to the graduate housing context by including only the dimensions relevant to residential settings: place identity, place dependence, ambient bonding, and social bonding. This approach is consistent with recent research emphasizing the importance of context in place attachment and supports extending the dimensions beyond the original framework [24].

Statistical analyses were performed using IBM SPSS Statistics version 27.0. The normality of the questionnaire variables was assessed using the Shapiro–Wilk test. As several variables deviated from a normal dis-

tribution, Spearman's rank-order correlation analysis was employed to examine the relationships between the perceived affective quality (PAQ) dimensions and the place attachment subscales (place identity, place dependence, ambient bonding, and social bonding). Statistical significance was set at $p < 0.05$.

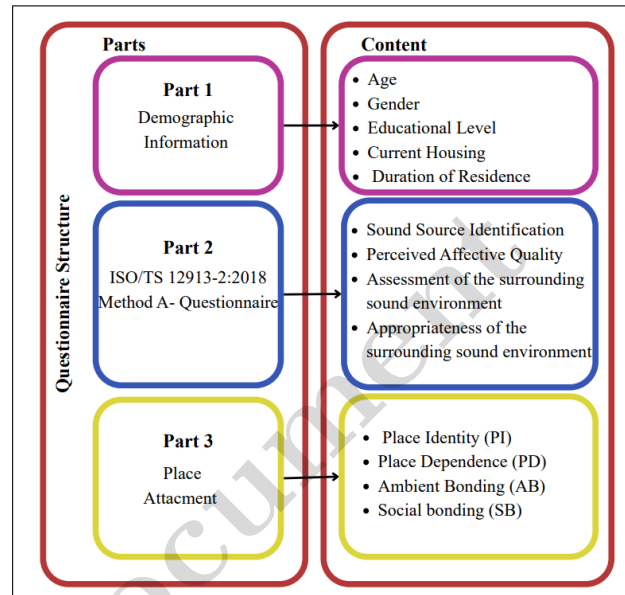


Figure 2: The Structure of the Questionnaire

Statistical analyses were conducted utilizing IBM SPSS Statistics 27.0. The distribution of the variables was assessed using the Shapiro–Wilk test. Given that the findings revealed deviations from normality in multiple components of the questionnaire, non-parametric statistical methods were employed for the inferential analyses.

All statistical analyses were performed using a significance threshold of $p < 0.05$. Spearman's rank-order correlation analysis was utilized to investigate the relationships among attributes of soundscape perception such as calmness, pleasantness, and annoyance, alongside the dimensions of place attachment (PA), which include place identity (PI), place dependence (PD), ambient bonding (AB), and social bonding (SB).

3. Results and Discussion

In-situ LAeq measurements see Table 1. confirmed that the three housing types differ substantially in their objective acoustic conditions. Housing 79 exhibited the highest sound pressure level (LAeq = 46 dB(A)), consistent with its location adjacent to the American football field and shared bathroom/kitchen layout. Housing 75, situated at the highest point of the campus, showed a moderate level (LAeq = 31 dB(A)), while Housing 107, the most recently constructed building with en-suite rooms near Bilkent Lake, recorded the lowest level (LAeq = 28 dB(A)). These measured differences broadly align with the buildings' spatial configurations described in Section

Table 1: Housing characteristics and measured L(A)eq values across the three graduate housing units

Housing Name	Resident Type	Room Type	Measured L(A)eq
Housing 75	Bachelor & Master's Students	Shared Bathroom /Kitchen	31 dB(A)
Housing 79	Master's & PhD Students	Shared Bathroom /Kitchen	46 dB(A)
Housing 107	PhD Students	En-suite	28 dB(A)

2.1, with proximity to active outdoor uses (Housing 79) corresponding to the highest recorded noise level and greater room-level acoustic privacy (Housing 107) corresponding to the lowest.

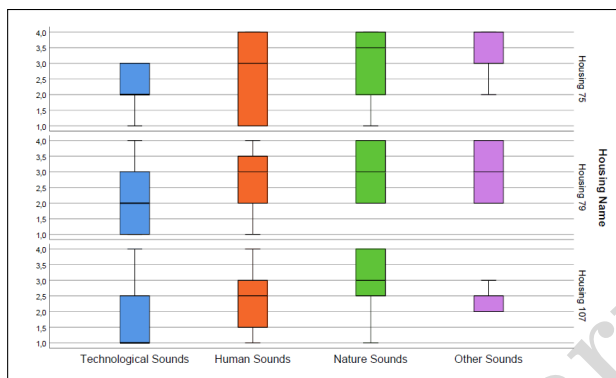


Figure 3: Boxplots of Dominant Sound Source Ratings Across the Three Housing Areas

Figure 3 summarizes participants' evaluations of the dominant sound sources across the three housing types. Nature sounds were consistently rated highest in Housing 107, reflecting the building's location adjacent to wooded areas and Bilkent Lake. Human sounds were most prominent in Housing 79, consistent with the building's shared kitchen layout and proximity to kindergarten and American Football field. Housing 75 exhibited relatively greater influence from technological sounds compared with the other residences.

As illustrated in Fig. 4, the two-dimensional circumplex model presents the mean ratings for the eight ISO 12913 soundscape perception dimensions. Residents of Housing 107 reported the highest ratings for pleasant and calm, indicating that this environment was generally perceived as the most restorative and acoustically comfortable. Conversely, Housing 79 received comparatively higher ratings for chaotic, annoying, and eventful, suggesting that residents experienced a more dynamic and potentially disruptive sound environment. Housing 75 showed

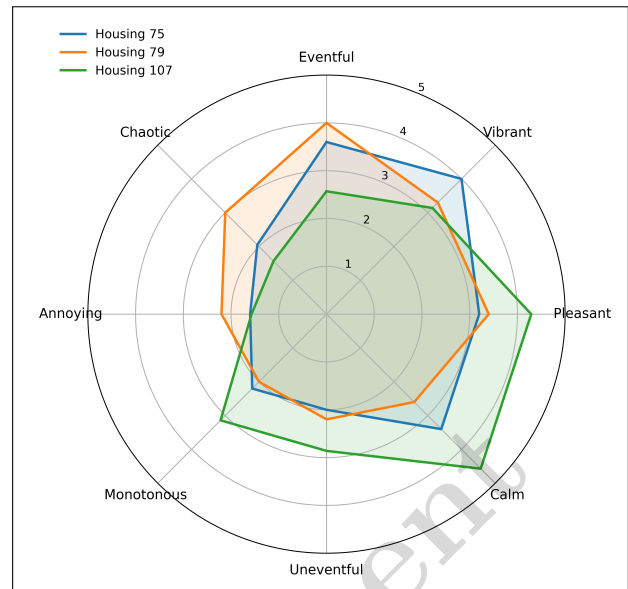


Figure 4: Perceived Affective Quality (PAQ) Scores Across the Three Housing Areas

relatively high ratings for vibrant, while maintaining moderate evaluations across the remaining perceptual dimensions. The lower calmness and pleasantness ratings observed in Housing 79 appear consistent with its higher measured LAeq values and its proximity to kindergarten and transportation. In contrast, the quieter setting of Housing 107, characterized by surrounding vegetation and greater spatial separation from major campus activities, likely contributed to its higher calmness ratings. These findings support previous soundscape research demonstrating that evaluations are strongly influenced not only by sound intensity but also by environmental context and surrounding landscape characteristics. These findings are consistent with the soundscape framework proposed in ISO 12913-1, which emphasizes that soundscape perception emerges through the interaction between acoustic conditions and contextual factors rather than sound levels alone [11]. They also support previous studies highlighting the influence of landscape characteristics and environmental context on perceived soundscape quality [13].

Table 2: Significant Spearman's rho Correlations Between PAQ and Place Attachment

Attributes	PI	PD	AB	SB
Pleasant	–	–	–	0.282*
Chaotic	–	–	–0.421	–
Vibrant	–	–	0.279*	–
Uneventful	0.423	–	–	–
Calm	0.497	0.356	0.352	–
Annoying	–	–	–0.384	–
Eventful	–0.450	–0.420	–	–0.443
Monotonous	–	–	–	0.416

The Spearman's rho analysis revealed several significant associations between PAQ dimensions and Place Attachment subscales (Table 2). The most notable pattern is that *Calm* and *Eventful* were each significantly related to three of the four subscales. *Calm* correlated positively with Place Identity ($\rho = .497$, $p < .01$), Place Dependence ($\rho = .356$, $p < .01$), and Ambient Bonding ($\rho = .352$, $p < .01$), while *Eventful* was negatively related to the same three dimensions, including Social Bonding (PI: $\rho = -.450$; PD: $\rho = -.420$; SB: $\rho = -.443$; all $p < .01$). This suggests that the calm–eventful axis of the PAQ circumplex model functions as a multidimensional predictor of students' attachment to their living environment. The prominence of calmness is also in line with previous indoor soundscape studies reporting that restorative and acoustically comfortable environments are generally evaluated more positively than acoustically demanding settings [16–23].

Pleasant ($\rho = .282$, $p < .05$) and *Vibrant* ($\rho = .279$, $p < .05$) showed weak-to-moderate positive correlations with Social Bonding and Ambient Bonding, respectively, while the more negatively valenced attributes *Chaotic* ($\rho = -.421$, $p < .01$) and *Annoying* ($\rho = -.384$, $p < .01$) were moderately and negatively related to Ambient Bonding. This symmetry suggests that perceived acoustic comfort particularly shapes ambient bonding — the emotional connection to the physical/natural environment — with chaotic and annoying sound weakening this bond and vibrant, pleasant sound strengthening it [8].

The positive relationship between *Uneventful* and Place Identity ($\rho = .423$, $p < .01$) appears, at first glance, consistent with *Eventful*'s negative relationship to Place Identity. However, because the two attributes relate to different subscales (*Uneventful* only to PI, versus *Eventful* to PI, PD, and SB), identity-based attachment among students may be driven less by eventfulness per se and more by the predictability of the sound environment and its associated lower cognitive load. Similarly, the positive association between *Monotonous* and Social Bonding ($\rho = .416$, $p < .01$) is somewhat counterintuitive, since monotony is typically evaluated negatively; this finding may indicate that, in settings where students have formed strong social bonds, acoustic variety or complexity becomes a secondary concern — that is, social bonding may buffer against the discomfort of a monotonous soundscape.

Taken together, the results indicate that soundscape perception affects different dimensions of place attachment through distinct mechanisms: calm and pleasant attributes reinforce identity- and environment-based attachment, whereas chaotic and highly arousing attributes primarily weaken identity- and social-based attachment. These findings suggest that acoustic comfort in campus housing design should not be treated merely as a technical issue of noise reduction, but as a design parameter that actively supports students' emotional and social at-

tachment to place. This interpretation aligns with the soundscape approach, which considers the acoustic environment as an integral component of the overall environmental experience rather than an isolated physical phenomenon [11,13].

4. Conclusion

This study demonstrated that soundscape perception is closely associated with place attachment in graduate student housing. Rather than being determined by sound levels alone, positive soundscape evaluations appeared to emerge from the interaction between the acoustic environment and the surrounding spatial context. Housing environments offering greater acoustic privacy, natural surroundings, and separation from intensive campus activities were more frequently perceived as calm and pleasant, and these perceptions were associated with stronger place identity, place dependence, and ambient bonding. Conversely, environments characterized by more dynamic and intrusive sound conditions tended to weaken these dimensions of attachment.

In addition to these empirical findings, this study demonstrates the value of integrating the ISO/TS 12913-2 Method A questionnaire with multidimensional place attachment measures. Rather than evaluating residential soundscapes solely in terms of perceptual quality, this integrated approach also captures how soundscape perceptions relate to students' emotional and functional connections to their living environment, providing a more comprehensive understanding of residential soundscape experience.

These findings suggest that place attachment is influenced not only by what residents hear, but also by how the physical characteristics of the residential setting shape the interpretation of the acoustic environment. From a design perspective, creating positive residential soundscapes therefore requires considering spatial configuration, landscape features, and acoustic design together, rather than focusing solely on noise reduction. Although the present findings provide encouraging evidence, they should be interpreted with caution due to the relatively small sample size. Future studies involving larger and more diverse residential settings are needed to further examine the relationship between soundscape perception and place attachment.

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