



Multimodal and scale-sensitive assessment of sense of place in residential areas of Ankara, Turkey

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Abstract

In order to make the phenomenological concept sense of place (SoP) pragmatic in design and planning, this research investigates the SoP indicators concerning spatial scales of the physical environment. Seven indicators are extracted from the literature, namely ‘place identity’, ‘place dependence’, ‘nature bonding’, ‘social bonding’, ‘sense of belonging’, ‘familiarity’ and ‘social interaction’. In this paper, their relevance was discussed against ‘place attachment’ which is used interchangeably with SoP in the literature. ‘Place attachment’ and the seven indicators were scored through interviews with residents in general and at the building, street and neighbourhood scales, in six housing developments selected from Ankara, Turkey. The residents rated their experiences regarding a set of statements for each indicator using the seven-point Likert scale. The data sets then were validated statistically. The correlations between each indicator and ‘place attachment’ in general and at the three scales were identified. The results showed that ‘place identity’ and ‘place dependence’ were the most relevant indicators to SoP, at the street and neighbourhood scales in particular. The second most relevant indicators were ‘sense of belonging’ and ‘social bonding’ at the building and street scales and ‘social interaction’ at the street scale. The research suggests that these five indicators could be employed to evaluate SoP at all scales or guide place-making at a particular spatial scale in planning and design.

Keywords Sense of place · Spatial scale · Place attachment · Residential environment · Ankara

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1 Introduction

The built environment is primarily shaped by design and planning actions today and affects human behaviours (Smith 2011). The physical spaces enable people to develop attachment, endow meanings and relate memories through activities and interactions, which makes spaces a place (Low and Altman 1992; Punter 1991; Relph 1976). Place-making through design and planning interventions is an important goal, particularly in the pursuit of the socio-cultural sustainability of the residential environments. SoP is an abstract concept affected by objective and subjective factors and thus hard to measure (McCrea et al. 2006; Raymond et al. 2017; Shamai and Ilatov 2005). This research puts forward a scale-sensitive approach to measure SoP in the residential areas to help designers and planners understand the relationship between the built environment and SoP and act accordingly in their practice.

This paper attempts to understand the abstract concept of SoP through a set of tangible indicators at three commonly concerned spatial scales in design and planning, namely the building, street and neighbourhood scales. Through an intensive literature review, the research employs 'place attachment' as a measurable alternative to SoP (e.g., Low and Altman 1992; Raymond et al. 2010; Shamai, 1991; Shamai and Ilatov 2005; Vanclay 2008; Williams et al. 1992). The study also identifies seven indicators from the literature constructing SoP, namely 'place identity', 'place dependency', 'nature bonding', 'social bonding', 'sense of belonging', 'familiarity' and social interaction. The research tests the scores of 'place attachment' and the seven indicators via interviews with households in six selected housing developments in Ankara. After that, the correlations between the seven indicators and 'place attachment' at the three spatial scales are investigated, to find out the most relevant indicators of SoP at a particular scale. The study asks the following two questions: (1) How SoP or 'place attachment' can be understood or assessed at the three spatial scales? (2) What are the most relevant indicators of SoP or 'place attachment' at each spatial scale? The identified indicators and the ways through which they are measured in this research can help designers and planners understand the impact of the built environment on place-making at the three scales. The most relevant indicators can also form an evaluation framework of SoP which could be applied to other residential developments to assess the impact of design and planning actions.

2 Literature review

2.1 Place, sense of place and place attachment

Place is the product of lived experiences (Carmona et al. 2010; Dovey 1999; Relph 1976), involving physical, functional and psychological dimensions (Kaltenborn 1998; Lewicka 2010). It is understood from a variety of aspects (Arifwidodo and Chandrasiri 2013; Beidler and Morrison 2016; Eisenhauer et al. 2000; Jorgensen and Steadman 2006; Low and Altman 1992; Shamai 1991). The physical environment is defined as 'an emotion carrier' and SoP is people's 'affective ties with the material environment' (Tuan 1974, p.93). The concept of SoP is associated with human perception, attitude, psychology and emotions towards space (e.g. Relph 1976; Tuan 1977, 1974). Many researchers echo this view and SoP is widely acknowledged as being multifaceted and affected by complex social, cultural

and physical factors (e.g. Hay 1998a; Hernandez et al. 2007; Lang 1987; Larson et al. 2013; Lewicka 2010; Lewis 1979; Shamai et al. 2012; Stedman 2003; Williams 2009).

Therefore, it is challenging to precisely define SoP, identify its causes and measure its intensity. Early studies on SoP were mainly phenomenological, as seen in the works of Tuan (1974), Relph (1976), Rapoport (1969), May (1970) and Low and Altman (1992). These studies argued that SoP could not be measured (Lewis 1979; Relph 1976; Shamai 1991; Sigmon et al. 2002) because it is uni-dimensional and cannot be divided into various constructs (Ardoin et al. 2012). However, recent studies have attempted to develop models to empirically measure SoP through multiple indicators to make it more tangible (e.g., Shamai and Ilatov 2005; Cross 2001; Eisenhauer et al. 2000; Jorgensen and Steadman 2006; Beidler and Morrison 2016).

In the literature, 'place attachment' is used interchangeably with SoP (e.g., Cross 2001; Eisenhauer et al. 2000; Relph 1976; Shamai et al. 2012; Shamai and Ilatov 2005; Tsaour et al. 2014; Tuan 1974; Vanclay 2008; Williams et al. 1992). It refers to 'the emotional link formed by an individual to a physical site that has been given meaning through interaction' (Milligan 1998, p.2). Scholars often regard it as the measurable alternative of SoP (Kaltenborn 1998; Semken 2005; Stedman 2003). This study thus tests the relevance of other indicators in relation to 'place attachment'. The following will review the seven indicators of SoP and 'place attachment' in the literature.

2.2 Indicators of sense of place or place attachment

'Place identity' and 'place dependence' are claimed to be relevant to 'place attachment' (Williams et al. 1992). 'Place identity' refers to the symbolic meaning of a place (Proshansky et al. 1983; Kyle et al. 2005; Raymond et al. 2010) and is defined by 'a person's individual and community identity' (Cross 2001; Watson and Bentley 2007). 'Place identity' is related to the spatial characteristics of the place and reflects the residents' preferences towards space. 'Place dependence' refers to the functional attachment to a place and is explained through the affordability of the physical settings to meet the residents' needs of activities (Schreyer et al. 1981, cited in Raymond et al. 2010; Stokols and Schumaker 1981). It often results from a comparison between the qualities of the place in question and the alternatives (Stokols and Skumaker 1981).

Some researchers (e.g. Jorgensen and Stedman 2001; Katsamagka 2013; Raymond et al. 2010) suggested other dimensions of 'place attachment', including 'nature bonding' and 'social bonding'. 'Nature bonding' refers to the connectedness to nature, both emotionally and functionally. It links to memories such as agricultural activities and is related to the access to nature and time spent in outdoor green spaces for leisure (e.g. Katsamagka 2013; Raymond et al. 2010; Uslu and Gokce 2010). People's satisfaction with 'social bonding' depends on whether meaningful social relationships have been established and maintained in a specific place (e.g. Cross 2001; Eisenhauer et al. 2000; Hay 1998a, 1998b; Hummon 1992; Kim 2000; Kyle et al. 2005; Perkins and Long 2002; Raymond et al. 2010; Tsaour et al. 2014; Uslu and Gokce 2010; Williams 2009).

The four indicators mentioned above are frequently discussed in the literature. There are also other less discussed indicators of 'place attachment' such as 'sense of belonging', 'familiarity' and 'social interaction'. 'Sense of belonging' (e.g., Hay 1998a, 1998b; Low and Altman 1992; Sakhaeifar and Ghoddusifar 2016; Shamai 1991; Sigmon et al. 2002; Smith 2011; Tuan 1974; Ujang and Zakariya 2015; Williams et al. 1992; Williams 2009) is considered as the 'feeling at home' (Pinet 1988, p.173). Home is not simply a shelter,

but the symbolic expression of the sense of belonging (Pinet, 1988) and tied to one's identity (Sigmon, et al. 2002, p.33). 'Familiarity' depends on the degree of cultural bonding with the physical environment and the constant engagement with space socially and visually (e.g. Hay 1998a, 1998b; Inalhan and Finch 2004; Kyle et al. 2005; Tuan 1974; Williams 2009). 'Social interaction' (e.g. Cross 2001; Eisenhauer et al. 2000; Ferriss 2006, Kim 2000; Ujang et al. 2018) refers to the opportunities offered by the space for people's interaction with each other. 'Social bonding' may be a result of 'social interaction', but the former stresses on the bonding while the latter on the opportunities for interactions (Lefebvre 1991, cited in Lotfi and Koohsari 2009; Ozaloglu 2006). To some extent, the seven indicators affect each other, but they could be measured individually through specific statements in interviews (Fig. 1, Table 1).

2.3 Sense of place in relation to spatial scales

The relationship between SoP and the physical space is not as well-studied as the social construction of SoP in phenomenology (e.g., Hidalgo and Hernandez 2001; Stedman 2003). The social and spiritual environment and the impact of socio-demographic factors on SoP have gathered the most attention. Specific physical characteristics of spaces are also discussed as relevant factors to SoP (e.g. density, public-private area relations, building heights, building types, building entry sequence, landscape design, the contrast between old and new buildings, site arrangements, public space design, borders) (See Lewicka 2010; Shamai et al. 2012). These physical characteristics can be captured in spatial types at a particular scale (Caniggia and Maffei 2001). The authors' earlier research has investigated the transformation of the spatial characteristics of the residential environments in Turkey and how such transformation affects the residents' SoP (Gokce 2017; Gokce and Chen 2018, 2019). Nevertheless, to what extent SoP and its attributes differ at different spatial scales is not adequately explored in the literature (Devine-Wright 2012; Kolodziejki 2014).

A place can refer to 'home, neighbourhood, city or community, state, region, or nation' (Nanzer 2004, p. 363). The attachments to a place could be formed at any level (e.g.,

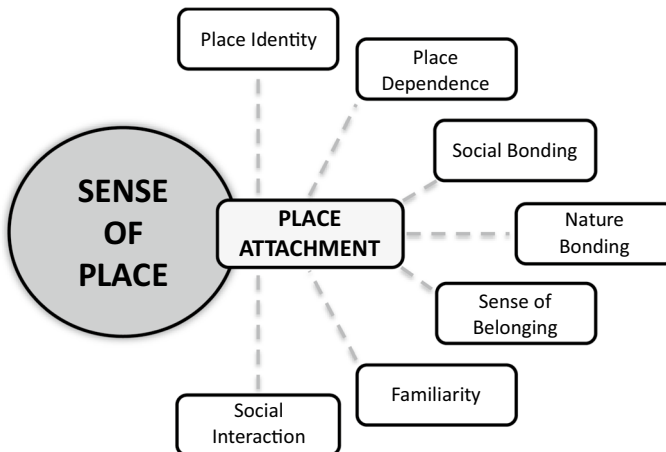


Fig. 1 The sense of place (SoP) model adopted in this study

Table 1 The interview statements at the three place scales

Indicators	The interview statements according to relevant place scales		
Place attachment (PREQIs, PAI and NAS)	I would be sorry to move out of this house/street/neighbourhood without the people I live with/ appreciate	B	S N
	I would be sorry if the people I lived with/appreciate moved out from this house/street/neighbourhood without me	B	S N
	I would be sorry if I and the people I lived with/appreciate moved out of my house/street/neighbourhood	B	S N
	I am very attached to my house/street/neighbourhood	B	S N
	This house/street/neighbourhood is very special to me	B	S N
	My house/street/neighbourhood has distinct features and shows my personal preference	B	S N
	I feel this house/street/neighbourhood is a part of me	B	S N
	My house/street/neighbourhood is significantly important to me	B	S N
	My house/street/neighbourhood is identifiable	B	S N
	My house street/neighbourhood is generally comfortable and functional	B	S N
Place dependence (PAI)	My house/street/neighbourhood is the best place for what I would like to do	B	S N
	No other place can compare to my house/street/neighbourhood	B	S N
	I get more satisfaction out of living in this house/street/neighbourhood	B	S N
	Doing what I do in my house/street/neighbourhood is more important to me than doing it in any other place	B	S N
	The house/street/neighbourhood is well associated with nature	B	S N
	My garden/balcony or green spaces in the street/neighbourhood is sufficient	B	S N
	I prefer spending time in the garden/balcony or communal spaces in my home, street and neighbourhood rather than the alternatives outside	B	S N
	There are specific activities performed in the garden/balcony or communal spaces in my street and neighbourhood	B	S N
	I would prefer to have a private garden rather than a communal garden/public space	B	S N
	I would prefer to live in a greener street/neighbourhood	B	S N
Nature bonding (PREQIs)	Green spaces and buildings are well balanced in the street/neighbourhood	S	N
	Green spaces encourage me to use the street/neighbourhood actively	S	N

Table 1 (continued)

Indicators	The interview statements according to relevant place scales			
Social bonding (PREQIs and NAS)	I feel social bonding is strong in my house/street/neighborhood	B	S	N
	People living in the same house/street/neighborhood think about themselves and have a little interest in others	B	S	N
	Doing things with people inside my home is more important than that outside home	B		
	I think the family/neighborhood values are respected in my street/neighborhood		S	N
	I am satisfied with my close relationships with family members/friends/neighbors in the house/street/neighborhood	B	S	N
	People of the same street/neighborhood are often acquainted		S	N
Sense of belonging (Smith, 2011, PAI and NAS)	I feel I belong to this house/street/neighborhood	B	S	N
	There is a peaceful rhythm of life in the house/street/neighborhood	B	S	N
	It is a street/neighborhood with many points of interest/ my house is not only a dormitory	B	S	N
	I think I am a part of this house/street/neighborhood	B	S	N
Familiarity (PREQIs, PAI and Ujang, 2008)	I feel familiar with my home/street/neighborhood	B	S	N
	I moved to this house/street/neighborhood because of its familiarity to me	B	S	N
	I feel this house/street/neighborhood reflects my cultural and social values	B	S	N
Social interaction (PREQIs)	Spatial organisation of the house/street/neighborhood provides enough opportunities for social interaction	B	S	N
	The size and spatial organisation of the house are suitable for the household to have good social contact with each other and for hosting guests	B		
	There is a lack of meeting places in this street/neighborhood		S	N
	This street/neighborhood is good for me to interact with other people		S	N

B: Building Scale S: Street Scale N: Neighbourhood Scale.

Bernardo and Palma-Oliveira 2013; 1993, cited in Deutsch et al. 2011; Hidalgo and Hernandez 2001; Lewicka 2010) and the measurement of SoP could be different at different spatial levels (Shamai 1991). Many studies of SoP referred to place as neighbourhoods or cities (Billig 2005; Billig and Churchman 2003; Brown 1981; Farshchi et al. 2014; Jiven and Larkham 2003; Ortiz et al. 2004), particularly the former (e.g. Billig 2005; Boerebach 2012; Brown and Werner 1985; Dariush and Lida 2015; Kolodziejcki 2014; Lewicka 2010; Shamai et al. 2012). Few studies have related SoP to buildings (e.g. Dariush and Lida 2015; Mazloomi et al. 2014). A small group of scholars have stressed that SoP varies at different spatial scales (Deutsch et al. 2011; Hidalgo and Hernandez 2001), but they have not gone further to explain the details.

The present study examines SoP concerning its seven indicators in the selected case studies at the three spatial scales. The SoP understanding at different spatial scales has the potential to help designers and planners make appropriate design decisions and benefit place-making.

3 Methodology

With regards to research design, this section firstly introduces the selected housing developments in Ankara and their different spatial typologies. It then justifies the specific interview questions regarding the overall SoP and the indicators and explains how the interviews were conducted. It is followed by an explanation of the ways through which we process the interview data.

3.1 Study cases

The selected cases were from Ankara, a city located in the north–west of Central Anatolia and has had a long history of urban development. Ankara became the new capital city after the proclamation of the Republic of Turkey in 1923. The desire and the efforts in creating a modern capital have deeply affected its urban development. Social, cultural, economic and political changes have substantially transformed the city's morphology. These included the increasing migration rate and the housing shortage after WWII, the dominant influence of European architects and planners in the design of the new capital, the lack of government legislation in design and the frequent changes of building regulations. Consequently, a variety of housing, street and neighbourhood typologies have emerged in Ankara. The housing types that exist in the city today include: traditional Turkish wooden houses emerged during the late Ottoman Empire period (1890s–1923); single-family terrace houses from the early Republican period (1923–1950); low-rise (individual) apartment buildings developed during the modernist period (1950–1980); medium-rise apartment buildings of gated communities built by housing cooperatives in the Liberalism period (1980–2000); and high-rise apartment buildings of the gated community since the 2000s.

This research selected six mid-income housing developments representing the typologies mentioned above in the city of Ankara. The six cases were located in similar urban areas in the city to minimise the effect of the locational factors (e.g., land value) on SoP. The authors refer to the selected housing developments as Case I to Case VI in the rest of the paper (See Fig. 2). Case I is the unplanned traditional single-family wooden houses and Case II is the low-rise apartment blocks. Case III is the terrace housing units, while Case






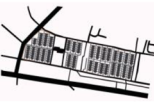



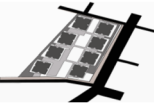


		Built Period	Building Height	Land Coverage	Housing Typology	Neighbourhood Typology	Planning & Management Type	Neighbourhood Layout
Case I		18-19 th century	Low-rise	High Coverage	Individual housing units	Each housing unit has a private garden	Unplanned Open site	
Case II		1950s	Low-rise	High Coverage	3 floor apartment buildings (2-3 flats per floor)	Each building has its own front garden	Planned Open site	
Case III		1980s	Low-rise	Medium Coverage	2-3 floor terrace houses	Each house has a private front garden	Gated community	
Case IV		1990s	Medium-rise	Medium Coverage	5 floor apartment buildings (4 flats per floor)	5 buildings arranged in a block	Gated community	
Case V		1990s	Medium-rise	Medium Coverage	5 floor apartment buildings (4 flats per floor)	5 buildings arranged in a block	Gated community	
Case VI		2000s	High-rise	Low Coverage	12 floor apartment buildings (4 flats per floor)	2 buildings arranged in a block	Gated community	

Fig. 2 Case description

IV and V are the medium-rise apartment blocks. Case VI is the high-rises. The latter four cases are all planned gated communities.

3.2 Interview design

The interview questions were designed to generate four data sets (A, B, C and D) (Fig. 3) and to assess ‘place attachment’ and the seven indicators mentioned above (Sect. 2.2) respectively. The first set (A) was a general SoP evaluation of the residential development and used to check the consistency of the other three sets. Data sets B, C and D provided a detailed assessment of the indicators, where the residents scored against a series of statements at the building, street and neighbourhood scales, respectively (Table 1). Besides, the demographic data was collected from the participants and their effects on the results were statistically tested.

The interview questions were adapted from several relevant social and life quality surveys from the literature on residential satisfaction, place attachment and psychological wellbeing. These include the perceived residential environment quality indicators (PRE-QIs) and neighbourhood attachment scale (NAS) developed by Bonaiuto et al. (2003) and Bonaiuto, et al. (2015); and the place attachment instrument (PAI) proposed by Williams and Vaske (2003) and used by others (e.g. Bonaiuto et al. 1999, 2003, 2015; Fornara et al. 2010; Kaltenborn 1998; Kyle et al. 2004; Mao et al. 2015). The statements were explicitly adapted to be relevant to the three spatial scales (Table 1).

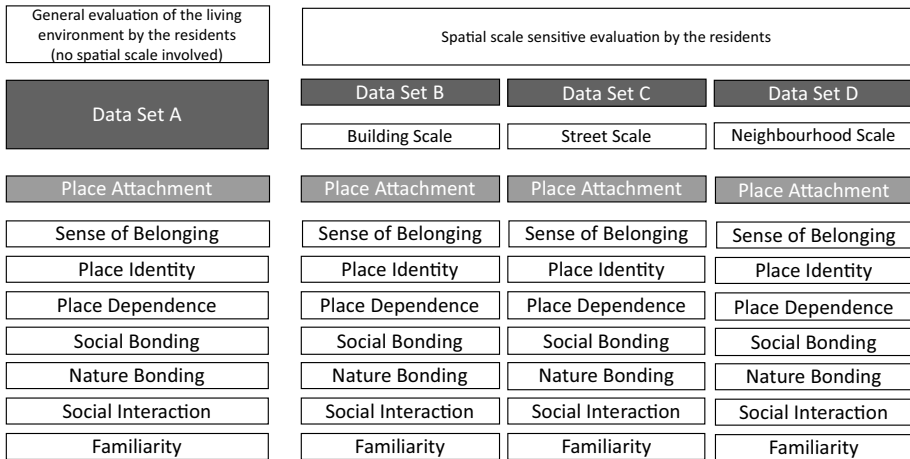


Fig. 3 The base data set categories collected in the interviews

3.3 Interview and data collection

In this study, 120 mid-income families in total were interviewed face-to-face (twenty families per case) in their homes and each lasted around 60–70 min. A seven-point Likert scale was used to quantify their experiences (e.g. Nanzer 2004; Shamai 1991). The questions or statements in Table 1 were translated into Turkish by the lead author in writing and verbally. Further explanations on specific points were provided verbally if the interviewees requested. The households were asked to form an agreed rating among the family members for each question to minimise the possible impact of personal circumstances. Furthermore, the impact of the demographic variables was tested statistically as the demographic data was collected at the beginning of each interview. The seven indicators and ‘place attachment’ were evaluated in general first, followed by the evaluations of each indicator at the three spatial scales, respectively, as shown in Fig. 3. At the building scale, the statements referred to the house’s spatial configuration of several function areas; the street layouts of buildings-plots arrangement along a residential street at the street scale; and the neighbourhood layout in terms of the arrangement of buildings and street networks at the neighbourhood scale. The scores obtained from the surveys were analysed in the SPSS software.

3.4 Data processing

The data collected from the interviews were processed in four steps, as shown in Fig. 4. First, validity and reliability tests were run in SPSS. Second, the impacts of the demographic variables on the results were tested. Third, Data Set A regarding the indicators in general was processed to validate the research design, followed by the analysis of the data sets B, C and D on the seven indicators at the three scales.

The weighted sums of the indicators are calculated from all four data sets separately and the consistency of the scores was checked. For the aggregated mean values, any rating beyond six was considered to be very high; between five and six high; between four and five moderate; and less than four was deemed low. Then, to what degree SoP or ‘place

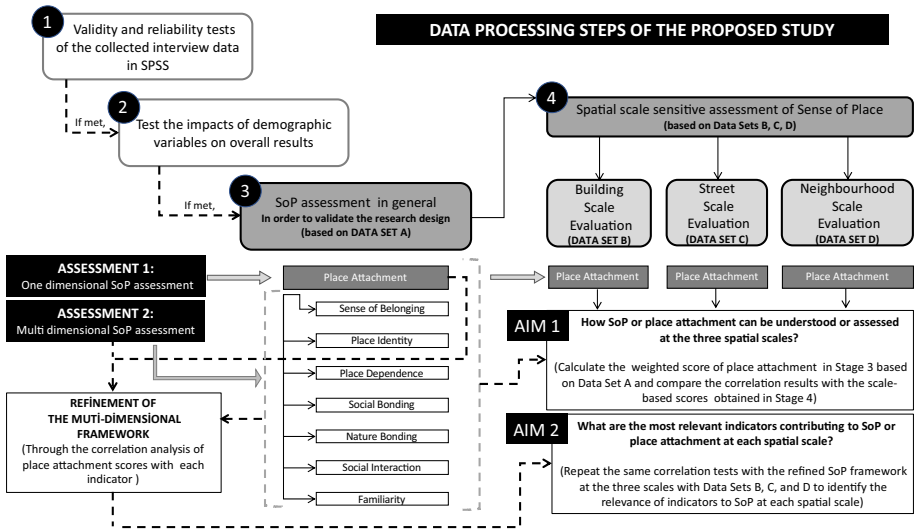


Fig. 4 Data processing steps of the study

attachment' is different at the three spatial scales is explained through the correlations of the scale-based data sets (B, C and D) against Data Set A. The proposed multi-dimensional SoP model was also validated through comparing the correlation between the scores of 'place attachment' and the seven indicators in Data Set A, first, then, if validated, in the data sets B, C and D to identify the relevance of each indicator at the three spatial scales. The correlation scores (r) were evaluated according to Cohen (1988)'s standard in four main categories: Small = 0.10, Medium = 0.20, Large = 0.50 and Very large = 0.70.

4 Results

This section reports the results of the analysis explained above. First, it reports the statistical validity and reliability of the collected interview data; second, it shows the test results of the impacts of the demographic variables; third, it explains the validity of the proposed research design; fourth, it discusses the relevance of each indicator at the three scales through the correlation scores of each indicator with 'place attachment' at the three scales.

4.1 Internal consistency and validity of the interview data

The internal consistency of the scales is tested for the four main data sets and the individual scales related to each indicator. Cronbach's alfa values of 0.6–0.7 are the lowest acceptable threshold used in exploratory research (Nunnally and Bernstein 1994). The items in each data set have met the threshold and showed internal consistency, as shown in Tables 2 and 3, respectively.

Table 2 Reliability test results of the research instrument based on four main data sets

	Data set A (General)	Data set B (Building scale)	Data set C (Street scale)	Data set D (Neighbourhood scale)
Cronbach's alpha	0.777	0.699	0.936	0.875
No. of items	8	8	8	8

Validity tests have been conducted using Pearson correlations in SPSS, where the significant correlations of each item with the total score indicate that those items are valid and reliable (results shown in Table 4).

4.2 The impact of demographic variables

The possible impact of the demographic variables on SoP was tested, including age, gender, education, ownership status and the length of residence, which were believed to be essential for SoP in the literature (Hay 1998a; Hernandez et al. 2007; Lewicka 2010; Shamaï et al. 2012; Smith 2011; Stedman 2003). The test was carried out at two levels: The impact of a particular variable and the impact of the interactions between a variable and the housing typology (physical characteristics). The impact is shown through the *p*-values and it is insignificant if the *p*-value > 0.05 (Field 2009). This research had deliberately sought consensus among the members of the households on their responses to the interview questions to minimise the possible impact of demographic factors on SoP. Indeed, such impact was found insignificant statistically compared to those of the spatial typologies. Nevertheless, the impact of the length of residence in the city was apparent (*p*-value: 0.019) at the street scale. Moreover, only the impact of the interactions between a few demographic variables and the housing typology was more noticeable. These demographic variables were: education level (*p*-value: 0.009), profession (*p*-value: 0.032), length of residence in the district (*p*-value: 0.037) and length of residence in the city (*p*-value: 0.002) at the street scale; as well as the education level (*p*-value: 0.028) at the neighbourhood scale. However, from a comparative perspective, the calculated effect sizes showed that those impacts on SoP were much less than spatial typologies. Therefore, SoP scores obtained in this research can be mainly attributed to the housing typologies, in other words, to the physical characteristics of the environment at the three spatial scales.

4.3 Validation of the research design

SoP scores fluctuate in different housing cases and at different spatial scales in all four data sets, as shown in Fig. 5. By comparing the four data sets, it can be seen that the highest SoP scores were achieved at the general level compared to the scores at the building, street and neighbourhood scales. Arguably, it is because the general SoP scores may be affected by other factors in addition to the physical environment. When specific levels of the physical environment were considered, it is easier for residents to recall the negative aspects of their buildings, streets and neighbourhoods, but then, the scores are more specifically related to the physical characteristics. Nevertheless, a similar trend was noted between the

Table 3 Reliability test results of the research instrument based on eight indicators

	Place attachment	Place identity	Place dependence	Nature bonding	Social bonding	Familiarity	Social interaction	Sense of belonging
Cronbach's alpha	0.952	0.940	0.836	0.760	0.889	0.818	0.732	0.873
No. of items	15	12	15	17	21	9	12	12

Table 4 Validity test results of the research instrument based on four data sets and eight indicators

		Sense of belonging							
		Social interaction	Place identity	Place dependence	Nature bonding	Social bonding	Familiarity	Place attachment	
Total data set A (general)	Pearson Correlation	0.625**	0.748**	0.696**	0.346**	0.601**	0.666**	0.679**	0.608**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	120	120	120	120	120	120	120	120
Total data set B (building)	Pearson Correlation	0.638**	0.497**	0.835**	0.647**	0.422**	0.599**	0.395**	0.771**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	120	120	120	120	120	120	120	120
Total data set C (street)	Pearson Correlation	0.875**	0.920**	0.892**	0.786**	0.720**	0.864**	0.781**	0.850**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	120	120	120	120	120	120	120	120
Total data set D (neighbourhood)	Pearson Correlation	0.781**	0.674**	0.838**	0.832**	0.504**	0.738**	0.738**	0.868**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	120	120	120	120	120	120	120	120

**Significant correlation where the Pearson correlation value is more than 0.05 (2-tailed)

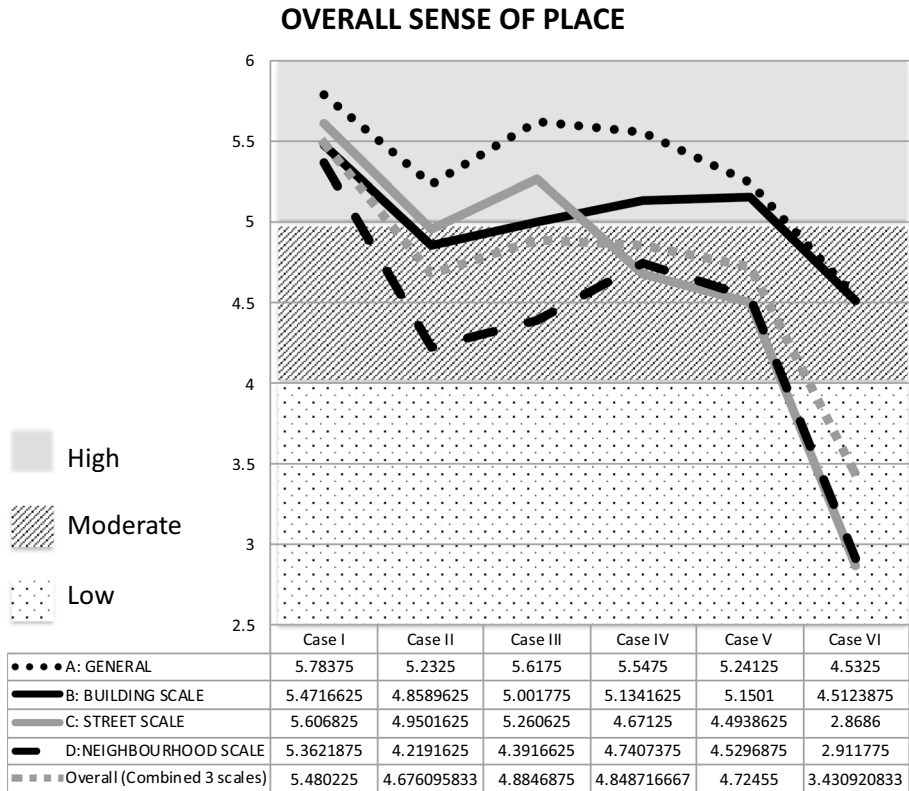


Fig. 5 The comparison of the overall SoP scores

general evaluation and the combined scores of the evaluations at the three spatial scales, which proves the internal reliability and consistency of the data sets.

Alternatively, the correlation tests were run between the general evaluation (A) and the scale-related evaluations one by one (B, C, D) and *very large* correlations were obtained between the data sets ($r=0.885$ at the building scale, $r=0.949$ at the street scale, $r=0.941$ at the neighbourhood scale). It answers the first research question and confirms that SoP is achieved in different intensities at the three spatial scales (Fig. 5). It also validates that the residents develop strong SoP or attachments to their living environment at all three place scales, although it is significantly lower in Case VI.

The final correlation testing for the validity of the research design was performed between the scores of ‘place attachment’ and the scores of the rest of the indicators in Data Set A. All seven indicators extracted from the literature showed at least large ($r > 0.5$) correlation (Table 5) and thus are all valid to be included in the scale-sensitive assessment. It is worth noting here that the relative correlations between the indicators and ‘place attachment’ are only used to check the validity of the research design. They are not included in the discussion about their relevance to SoP because the general score are not explicitly attributed to the physical environment. For example, the scores in general for ‘social bonding’ and ‘familiarity’ may have been affected by socio-cultural factors.

Table 5 Correlation testing for determining the relevance of indicators

	Sense of belonging	Place identity	Place dependence	Nature bonding	Social bonding	Familiarity	Social interaction	Place attachment
Sense of belonging	1	-	-	-	-	-	-	-
Place identity	0.896209	1	-	-	-	-	-	-
Place dependence	0.797458	0.594670	1	-	-	-	-	-
Nature bonding	0.738050	0.712916	0.279386	1	-	-	-	-
Social bonding	0.913276	0.838605	0.614327	0.896809	1	-	-	-
Familiarity	0.460031	0.598738	0.265857	0.470614	0.660145	1	-	-
Social interaction	0.992365	0.883820	0.738119	0.777292	0.933300	0.490096	1	-
Place attachment	0.675781	0.703187	0.559183	0.689420	0.845172	0.819232	0.664704	1

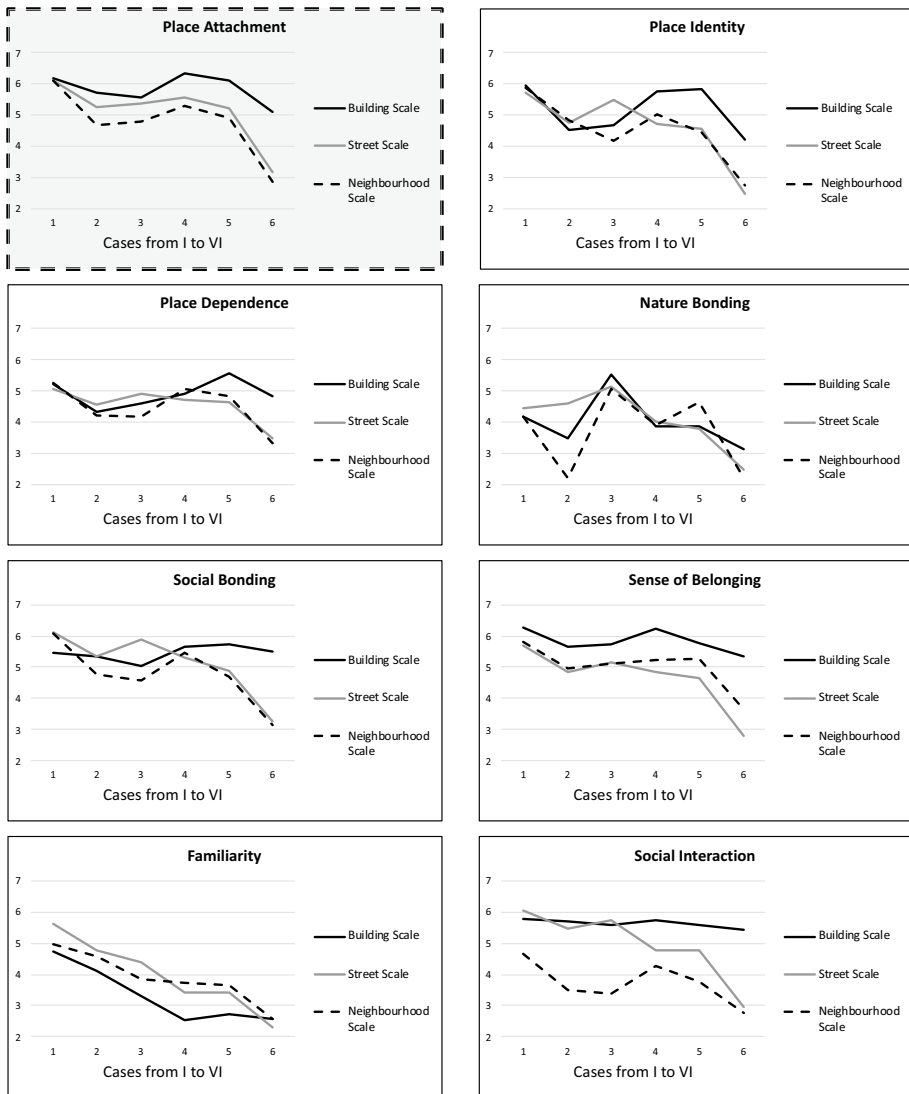


Fig. 6 Indicator based scores at the building, street and neighbourhood scales

4.4 The relevance of each indicator to ‘place attachment’ at the three scales

In order to determine the relevance of each indicator to SoP or ‘place attachment’ at the three scales, firstly, the weighted sum of the individual scores of seven indicators were calculated separately for six housing developments at the building, street and neighbourhood scales (Fig. 6).

Table 6 The correlation matrixes for SoP indicators at the three scales (all cases summed up)

Building scale	Sense of belonging	Place identity	Place dependence	Nature bonding	Social bonding	Familiarity	Social interaction	Place attachment
Sense of belonging	1	-	-	-	-	-	-	-
Place identity	0.82221	1	-	-	-	-	-	-
Place dependence	0.35417	0.80592	1	-	-	-	-	-
Nature bonding	0.26553	0.11713	-0.03206	1	-	-	-	-
Social bonding	0.35849	0.63736	0.69663	-0.62866	1	-	-	-
Familiarity	0.10667	0.15501	0.01076	0.17068	-0.28425	1	-	-
Social interaction	0.62255	0.26693	-0.28576	0.06008	0.07617	-0.05741	1	-
Place attachment	0.93737	0.91564	0.51272	0.12318	0.52431	0.15444	0.62478	1
Street scale	Sense of belonging	Place identity	Place dependence	Nature bonding	Social bonding	Familiarity	Social interaction	Place attachment
Sense of belonging	1	-	-	-	-	-	-	-
place Identity	0.97932	1	-	-	-	-	-	-
place dependence	0.98615	0.98590	1	-	-	-	-	-
Nature bonding	0.80700	0.89366	0.82022	1	-	-	-	-
Social bonding	0.96595	0.99279	0.97088	0.92184	1	-	-	-
Familiarity	0.90147	0.86999	0.82635	0.77918	0.86678	1	-	-
Social interaction	0.97071	0.97810	0.94606	0.89860	0.97456	0.94847	1	-
Place attachment	0.98283	0.95533	0.98459	0.77031	0.94646	0.82599	0.92555	1
Neighbourhood scale	Sense of belonging	Place identity	Place dependence	Nature bonding	Social bonding	Familiarity	Social interaction	Place attachment
Sense of belonging	1	-	-	-	-	-	-	-
Place identity	0.94217	1	-	-	-	-	-	-
Place dependence	0.93140	0.91458	1	-	-	-	-	-
Nature bonding	0.66405	0.39943	0.59565	1	-	-	-	-
Social bonding	0.95200	0.98306	0.94756	0.50303	1	-	-	-
Familiarity	0.84405	0.90099	0.67904	0.24686	0.83441	1	-	-
Social interaction	0.90080	0.93915	0.97770	0.49527	0.96276	0.69901	1	-
Place attachment	0.99133	0.96509	0.94699	0.62145	0.98278	0.84200	0.93511	1

*Small = 0.10, Medium = 0.20, Large = 0.50, Very large = 0.70.

After that, the correlations between each indicator and 'place attachment' were calculated at the three scales. Table 6 shows these correlations at the three scales for all cases together.

As shown in Table 6, three sets of the correlation scores have been calculated for six cases individually at the three scales and reported in four correlation categories, namely, small, medium, large and very large according to the Cohen's standard (1988) in Fig. 7.

According to the above categorisation (Fig. 7), the authors created a ranking system from one to six, amongst six case studies and identified the indicators showing at least a medium degree of relevance to 'place attachment' (Fig. 8). 'Place identity' and 'place dependence' are noted as the most relevant indicators of SoP in all cases (six out of six) at the street and neighbourhood scales. 'Place identity' (in five out of six cases, except Case V) and 'place dependence' (in four out of six cases, except Case III and VI) are proved to be important indicators at the building scale. The correlation results of 'sense of belonging' and 'social bonding' were also found noteworthy in five out of six cases at the building and street scales. 'Social bonding' (Case II, III, IV, VI) and 'social interaction' (Case II, III, V, VI) were the second most relevant indicators at the neighbourhood scale, reflected in the results of four out of six cases. 'Familiarity' did not meet any majority (four or more cases) amongst the cases at any scale, the same to 'nature bonding' at the street and neighbourhood scales. The relevance of 'nature bonding' was insignificant at the building scale.

5 Discussion and conclusion

Sense of place is dual and affected by both human emotion and the physical environment (Hummon 1992; Steele 1981). Nevertheless, the literature mainly emphasises its phenomenological features and its empirical assessment remains elusive. This paper has attempted to experiment with an empirical assessment of SoP concerning the three spatial scales. It made two contributions to the literature: (1) empirically tested whether SoP could be measured at three spatial scales through a framework of indicators extracted from the literature and (2) determined the degrees of relevance of the seven indicators, which would enhance designers and planners' understanding of SoP and benefit their design practise at the three spatial scales.

This study regarded 'place attachment' as the measurable alternative of SoP. The authors identified four most widely accepted indicators related to 'place attachment' or SoP from the phenomenology literature: 'place identity', 'place dependence', 'nature bonding' and 'social bonding'. Besides, the study extracted three more indicators which were believed to be pertinent to SoP from the broader literature, namely 'social interaction', 'familiarity' and 'sense of belonging'. The seven indicators formed a framework and were empirically tested by the authors in six selected housing developments in Ankara. The result supports Lewicka (2010)'s argument on type of housing as one of the predictors of 'place attachment'.

This study has empirically proved that the degrees of attachments towards a place differed at the building, street and neighbourhood scales in the given cultural context. A few studies (e.g. Low and Altman 1992) have claimed that attachments to a place can be formed at many levels, but this claim has not been sufficiently supported in the literature (Hidalgo and Hernandez 2001). Hidalgo and Hernandez (2001) specifically criticised studies taking 'neighbourhood range', as the 'basic level of attachment' to a community environment. In their study, they found that the residents developed the weakest attachment at

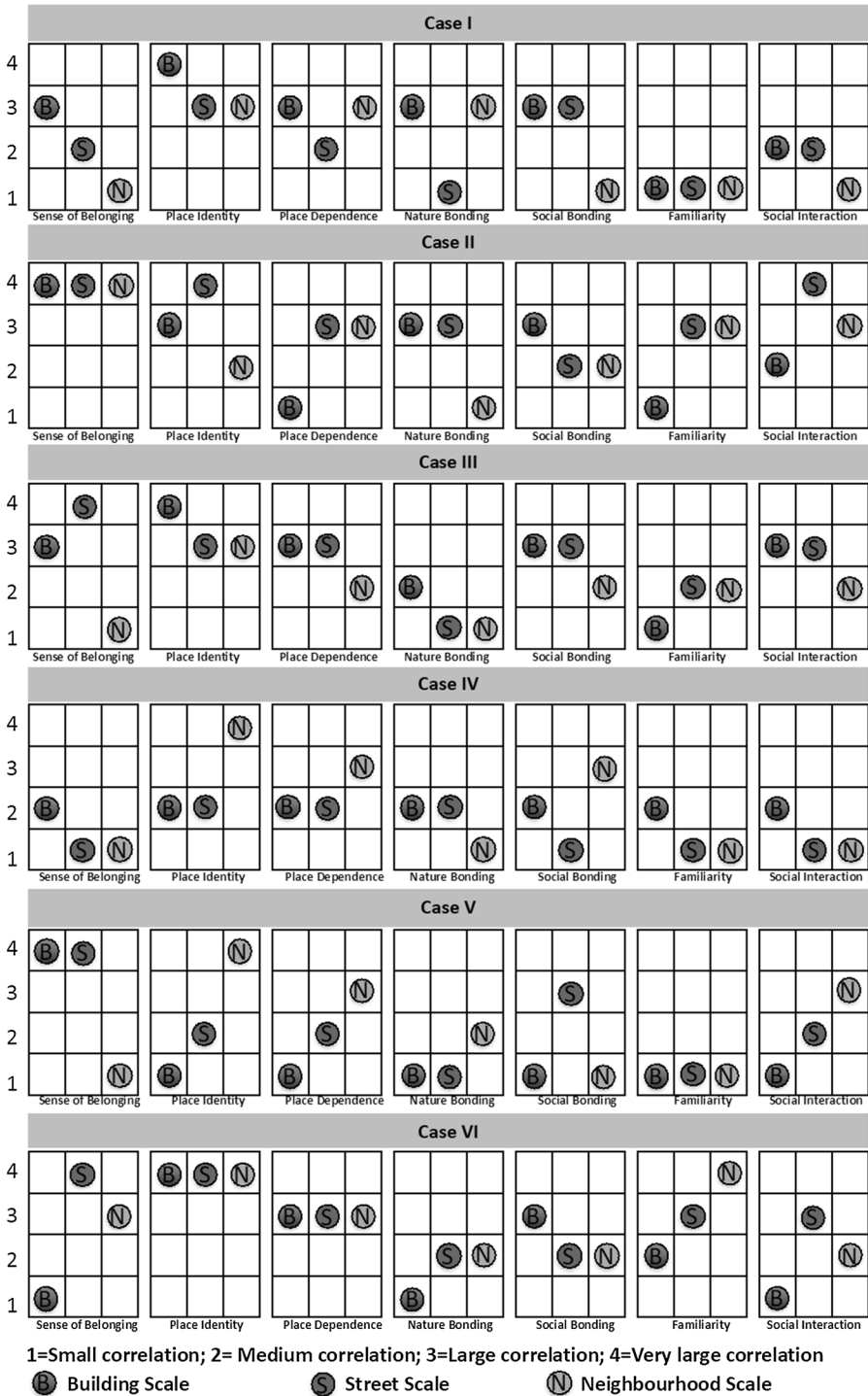


Fig. 7 Correlation between place attachment and other indicators case by case at the three scales

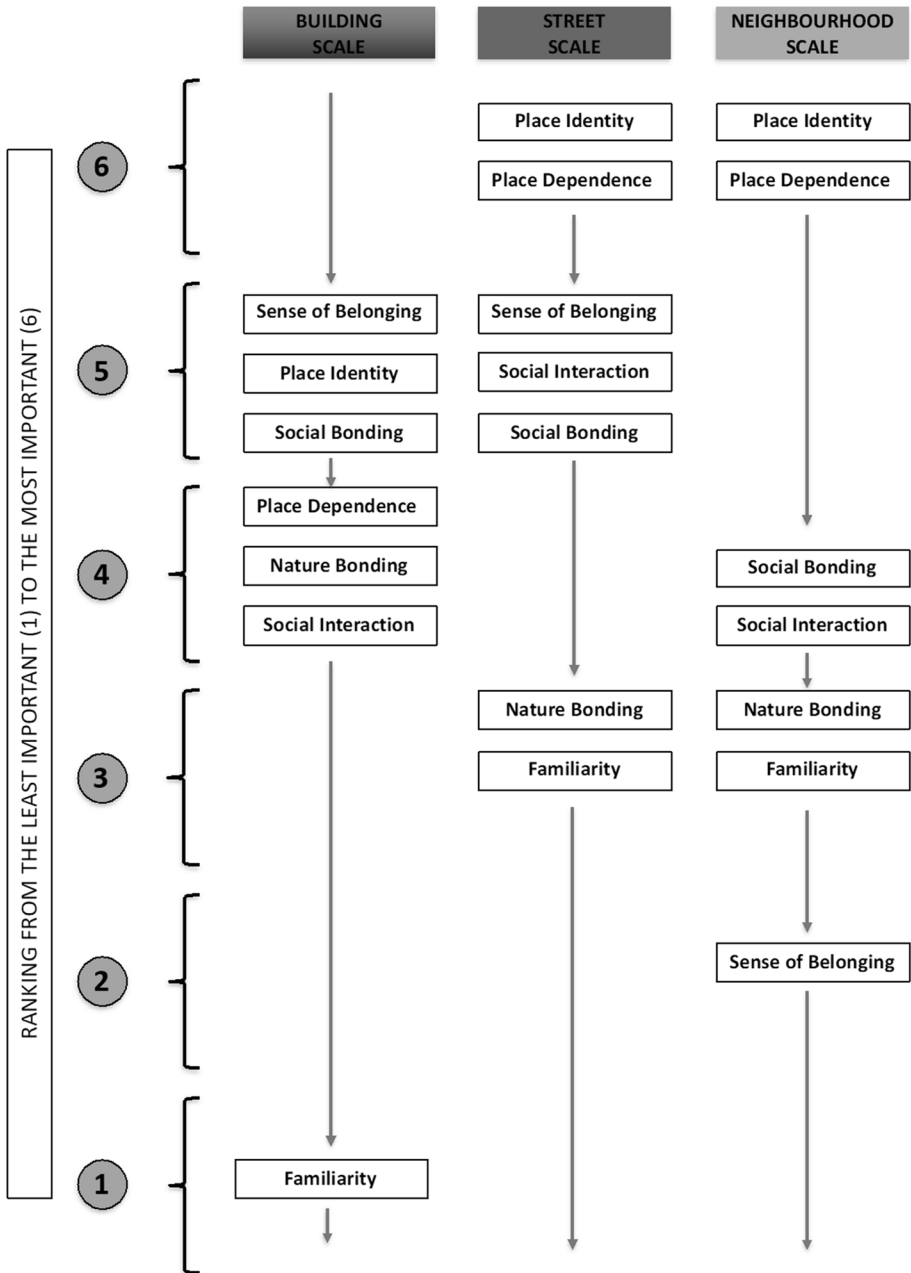


Fig. 8 The degree of relevance of the indicators to 'place attachment' or SoP at the three scales

the neighbourhood level, in comparison to the house and city levels, due to the decreased opportunities for social interaction within the neighbourhood. This paper partially echoes this finding as 'place attachment' was found the highest at the house level and the lowest

at the neighbourhood level (Fig. 6). It means that the design of the living environments in Ankara at larger scales like streets and neighbourhoods requires improvement. We acknowledge that the results may not be generalised and other cases need to be explored in the future.

Besides, this study proved that 'place identity' and 'place dependence' are the most critical indicators of 'place attachment' or SoP (Fig. 8). Their significance was, however, found more prominent at the street and neighbourhood scales. These two indicators refer to the functionality and the physical characteristics of space in order to meet residents' needs. In design and planning terms, places that can afford more useful functions and bear more culturally relevant characters help residents to develop SoP or 'place attachment'. Therefore, designers and planners should consider how to meet residents' functional needs in streets and neighbourhoods, such as the need for daily activities and socio-cultural events and make sure traditional typologies are reflected in their design and construction.

Furthermore, 'place identity', 'sense of belonging' and 'social bonding' were identified as the most important indicators at the building scale. It suggests that identity at the building level is also very relevant. Traditional building typology thus should be appropriately synthesised in new development to sustain the cultural identities. It further suggests that to benefit place-making, spaces in buildings should be sufficiently flexible and appropriate for different users. It is essential to allow the residents to re-appropriate and change spaces in order to enhance their emotional bonding with their family members.

Overall, this study suggests slightly varied evaluation frameworks of 'place attachment' or SoP at different spatial scales. The four indicators 'place identity', 'place dependency', 'sense of belonging' and 'social bonding' are the important ones, while 'natural bonding' and 'social interaction' can also be included at the building and street scales, respectively.

The study shows that specific physical characteristics of the cases are the main reasons for the higher scores of some indicators. At the street scale, for instance, the freestanding buildings (Case VI) result in overall lower scores of SoP than that of buildings aligning the streets (Case I, II and III). At the neighbourhood scale, gated communities received lower SoP scores than the traditional open site developments (Case I and II). More detailed observations on the physical characteristics of the cases can be discussed with the scores and the assessment statements of each indicator at the three scales. For example, it is clear that a comfortable and functional residential environment that is well associated with nature would encourage social interaction and provide a larger chance for the residents to establish SoP. Relevant research is reported in the authors' other papers in detail (Gokce 2017; Gokce and Chen 2018, 2019).

This research provides a useful tool to evaluate SoP as being affected by the built environment at three specific scales. It offers an opportunity for discussion around the impact of design and planning actions on SoP, in which place-making is a delicate matter and an ultimate objective. This research sheds light on the several vital ingredients of SoP to which design and planning should pay attention. Nevertheless, the research is limited in the sample sizes and the particular statements that measure each SoP indicator. Future research may increase the number of residential environments included in the study and the number of interviewees for each case. The statements may also be refined or adapted to evaluate the indicators at different scales or contexts. It would be an interesting topic to explore whether SoP assessment through the multimodal framework presented in this study would show similar results in other cultural contexts.

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