

Article

Environmental Satisfaction, Residential Satisfaction, and Place Attachment: The Cases of Long-Term Residents in Rural and Urban Areas in China

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Abstract: Drawing on literature from environmental psychology and urban planning, this study evaluates the relationships between environmental satisfaction, residential satisfaction, and place attachment in the context of both rural and urban areas in China. A field survey was carried out with 490 valid questionnaires collected in rural areas and 420 from urban areas in China. Partial least squares path modeling was applied for testing the relationships between the three main constructs. The results indicate a significant mediating role of residential satisfaction between environmental satisfaction and place attachment, suggesting the importance of residential satisfaction in residents' attachment-building to place. This study also found significant differences between rural and urban contexts with the mediating effect of residential satisfaction being absent from the rural sample.

Keywords: environmental psychology; place satisfaction; place attachment; urban and regional planning; China

1. Introduction

Residential satisfaction has long been a topic of great interest in environmental psychology [1–3]. It is defined as an attitude reflecting the fulfillment of residents living in a specific place in relation to their needs, expectations, and objectives [4,5]. A substantial amount of research has investigated the antecedents and consequences of residential satisfaction [3,4]. With respect to factors that influence residential satisfaction, the majority of research has focused on objective and subjective attributes of the residential environment as well as on the personal characteristics of residents [3,6,7]. Residential satisfaction has also been shown to be a critical predictor of cognitive, affective, and behavioral characteristics of the residents, including such aspects as life satisfaction [3], neighborhood attachment [8,9], mental/human wellbeing [10], and residential mobility [11].

A related attitude in the literature on environmental psychology is environmental satisfaction, which is defined as contentment with local environmental conditions and government environmental policies [12]. Both environmental satisfaction and residential satisfaction are influenced by characteristics of the environment (e.g., environmental quality [13] and are predictors of individuals' cognitive, affective, and behavioral characteristics, such as mental health, human comfort, and place attachment (e.g., [14]). Place attachment is comprehended as “a positive connection or bond between a person and a particular place” [15,16]. However, despite the extensive research on

residential and environmental satisfaction, there is a dearth of research investigating their relationship. Nevertheless, understanding the resident-place relationship from an individual, environmental, and socially sustainable point of view is critical for urban planning and development.

Investigations of how long-term resident-place relationships are constructed can provide great insights for researchers and policymakers, especially in developing countries characterized by rapid urbanization and severe environmental problems. For instance, China's urbanization rate increased from 30% in 1985–2013 [17] to 56.1% in 2015 [18], and is expected to reach over 70% by 2050 [18]. Rapid urbanization and industrialization have had negative environmental consequences [19] such as significant haze pollution [20]. Furthermore, urbanization has led to demographic changes in both urban and rural areas of China [21], resulting in particular phenomena such as the "elderly village" [17] in which younger people have migrated from rural villages to urban centers. Thus, in order to best formulate effective policies in urban and rural planning it is important to understand residents' attitudes and behavior toward both the environment and their domicile under these changing circumstances.

This study investigated the relationship between environmental satisfaction, residential satisfaction, and place attachment in rural and urban areas of China. A second-order structural model was proposed to capture the complexity in the paths between 13 latent variables and three second-order constructs. This model was tested using survey data on a sample of 904 residents in China (420 from urban areas and 484 from rural areas). The research contributes to the relevant literature in three ways. First, it enriches the understanding of how environmental satisfaction influences residential attitude and behaviors in the relationship between people and place. Second, it extends prior research on the factors that influence residential satisfaction by considering satisfaction with the local environment and government environmental policies. Third, the comparison of psychological relationships in rural and urban areas provides another perspective through which to investigate how residential psychology is affected by environmental differences [22,23].

2. Theoretical Frameworks

2.1. Residential Satisfaction

Residential satisfaction is a topic of great interest in geography, psychology, and urban planning studies [1,2,4,24,25]. Among the immense number of studies of residential satisfaction, some have analyzed satisfaction within a particular residential realm (house, neighborhood, or community/city) while many others have investigated overall residential satisfaction [22].

Residential satisfaction has been studied as an important criterion for evaluating residential environment quality [26] and has been explored in a number of contexts, including housing [27], health [28], finance [29], and leisure [30]. Analysis of the quality of life in a residential environment ranges from a focus on the individual to friendships, marriage, family, community, and place of residence [31,32], as well as different quality dimensions of the environment [33,34]. Perceived residential characteristics depend on individuals' cognitive understanding of natural and artificial endogenous and exogenous components as well as their perceived value [34].

Past research on evaluating environment quality from a resident's perception has developed a multidimensional construct with several psychological measures of specific aspects of environmental quality, including perceived environmental quality indices (PEQI) [30] and perceived residential environment quality indices (PREQI) [31,35]. Four macro aspects form the latter's indices: the spatial, human, functional, and contextual dimensions [31]. In this framework, the spatial dimension refers to architectural and urban planning while the human dimension refers to people and social relationships. The functional dimension refers to services and facilities within a given place, and the contextual dimension reflects the pace of life, environmental health, and pollution as well as upkeep and care.

2.2. Environmental Satisfaction

Environmental satisfaction is a specific response toward the natural environment. Prester, Rohrmann, and Schellhammer [36] argued that whether individuals participate in environmental activism is determined by their dissatisfaction with the condition of the environment and expectation of significant improvement of their environment quality. Based on this, Pelletier, Legault, and Tuson [12] developed a bidimensional residential satisfaction index. The first dimension involves the subjective appraisal of a given natural environment, including water quality, noise level, and air pollution, which indicates to what degree the given environment meets the expectations and needs of the residents. Natural environments bring many benefits for residents, such as restoration from negative affections and improvement of wellbeing [37–47]. Some studies also suggest that perceived natural environment conditions correlate to life/neighborhood satisfaction [48,49]. Above all, perceived natural environmental quality affects overall residential satisfaction.

The second dimension is the subjective assessment of government policies regarding the environment. Local government policy development related to the environment has a direct impact on resident psychology, reasoning, and further pro-environmental behaviors [50,51]. Poor government policies regarding the environment lead to negative resident attitude toward the government and further the place [52,53]. When residents have a positive attitude toward government environment policies, they have greater confidence in the quality of living conditions, which, in turn, enhances their satisfaction toward this place (e.g., [54]). Thus, satisfaction with government policies plays an important role in overall residential satisfaction. Based on the above analysis, this study hypothesized the following:

Hypothesis 1 (H1). *One's environmental satisfaction has a positive impact on his/her residential satisfaction with a given place.*

2.3. Place Attachment

The affective component of residential satisfaction has been studied in terms of affective quality and place attachment [8]. Many studies in different contexts, including attachment theory, recreation studies, tourism management studies, and environmental psychology, apply place attachment to describe the complex relationship between an individual and a given place [55–60]. Place attachment has been conceptualized in terms of its cognitive, affective, individual, and social dimensions [61,62].

The four widely accepted dimensions of place attachment are: (1) *Place identity* which is the outcome of the self-place identification process, whereby residents perceive and conceptualize themselves through a collective identity from a perspective centered on place [63]; (2) *Place dependence* that reflects a functional attachment, emphasizing the importance of the place in terms of how it provides necessary features and resources for basic living activities [15]; (3) *Affective attachment* which refers to what degree one is emotionally attached to a place, irrespective of evaluations, preferences, utilities, cognition, or objective judgments [64]; and (4) *Social bonding*, that indicates the social relationships in the people-place environment concerning human society as a collection or basic unity of family and friend zones [61,65].

Residential satisfaction has been considered an important predictor of place attachment [56,57,66]. Although “it is possible to be satisfied with where one lives and to not be particularly attached to place” [67], the majority of research views the relationship between these two constructs as positive [68]. Since residential satisfaction reflects cognitive evaluations of the residential environment, individuals tend to feel more strongly attached to a place if living in the place is perceived as meeting their needs, expectations, and objectives [69]. Comparative evaluations may also determine people's attachment to a place. For instance, individuals may feel more attached to a place if alternative places are not perceived to be better [70]. There has been much empirical evidence showing that residential satisfaction has a positive impact on place attachment in a variety of different contexts. Using a sample of 497 inhabitants from 20 different neighborhoods in Rome (Italy), Bonaiuto, Aiello, Perugini, Bonnes, and Ercolani [35] showed that residential satisfaction, operationalized in terms of multidimensional

perceived residential environment quality (PREQ), has a significantly positive effect on neighborhood attachment. Sam, Bayram, and Bilgel [71] obtained a similar finding in a sample of 466 inhabitants of 25 different neighborhoods in the metropolitan municipality of Bursa (Turkey), so as Beyer, Kamin, and Lang [72] using longitudinal data from a sample of 85 older, community-dwelling German adults. Furthermore, using survey data from a sample of 140 residents of two kibbutzim in Israel, Casakin and Reizer [73] found that individuals' residential satisfaction has a positive effect on place attachment, which then predicts their life satisfaction.

Some researchers have argued that place attachment is an indicator of satisfaction. Kyle, Mowen, and Tarrant [74] investigated the effect of place attachment on the perceived values of tourists and found that it is an important factor in explaining the variance of perceived values. When the function of a place is able to meet tourists' unique requirements, they develop an affective attachment to the place and then feel satisfied. This conclusion is supported by much research [75–77].

Both interpretations of the relationship between place satisfaction and place attachment have their theoretical arguments and empirical evidence. However, place satisfaction and place attachment likely intertwine and influence each other constantly in a dynamic fashion. This paper takes a practical point of view and chooses to study place attachment as the outcome construct for its context. Urbanization and migration are long-term processes and therefore require appropriate temporal perspectives in order to better understand residents' psychology, behavior, and associated contributions to sustainability at different scales. Investigating residential satisfaction is important but has only limited implications for local government policy-making and place strategies given the changing situations and circumstances that they face. Place attachment may therefore provide greater understanding of the multiple scales at which place processes occur due to its multi-dimensional nature. Therefore, this study proposed the following hypothesis:

Hypothesis 2 (H2). *One's residential satisfaction has a positive impact on his/her attachment to a given place.*

Extending previous discussion and propositions, a mediating effect of residential satisfaction can be proposed between environmental satisfaction and place attachment, and this bridging effect of residential satisfaction has been shown to be essential in previous studies in environmental psychology. Moser [78] argued that promoting people–environment congruity, a reflection of place attachment in place identity, requires looking beyond the singular effects of environmental features to consider people's overall relationship with their environment from their residential experiences. Other studies, such as [54], found evidence of trust in government and access to local natural resources interact directly with sense of place. Further, Shin [13] specifically noted that many studies of residential environments utilize satisfaction as an outcome of environmental factors and as a predictor of important constructs like place attachment. The literature overall suggests a partial mediation of residential satisfaction between environmental satisfaction and place attachment. Accordingly, the third hypothesis was proposed as follows:

Hypothesis 3 (H3). *Residential satisfaction can perform a mediating role between environmental satisfaction and place attachment.*

Previous research has suggested different predictors of quality of life in urban environment, compared to rural regions [79]. Rural residents were further found to be satisfied differently compared to urban residents [80]. The different types of environments and lifestyles of urban and rural residents' may lead to some fundamental variations between these two types of residents in their perception, evaluation, and long-term relationships with the place. Accordingly, the fourth hypothesis was proposed as follows:

Hypothesis 4 (H4). *The relationships proposed in previous hypotheses may vary between rural and urban contexts.*

3. Research Methods

3.1. Data Collection

A survey was implemented for this study with data collected from several sources. Rural data were collected from two villages in Shandong Province and from three villages in Heilongjiang Province in China from July to August 2014. Both are among the top ten largest agricultural provinces in the country and have a large proportion of rural residents. To collecting this data, we visited the villages involved in previous projects, which were typical and representative in terms of size, population, natural environment, and government policies. We input the telephone number of villagers provided by the local government in the computer and use random number program to select candidates to interview them at their home. A total of 484 valid questionnaires were included in the rural data analysis. For urban data, we adopted an existing dataset through an online survey portal held by WJX.cn, an online survey agent served 90% universities and research institutes in China that provided an urban sample from their sample panel via a random selection process, and then approached the respondents by email to ask them to complete an online questionnaire. The data was collected in April 2015. Participants could come from any cities in China, participation was voluntary, and consent was obtained from all respondents. The survey contains no sensitive content nor questions related to participants' personal information. In total, 1368 online survey entries were recorded and 420 valid questionnaires were obtained, resulting in a valid rate of 30.7%. The demographics of the sample are listed in Table 1.

In order to test the non-response bias of the online survey, we first compared the survey results to some known population parameters. For example, the rate of male to female respondents was approximately 1:1, which is close to the ratio across the whole country. In addition, the annual income of almost 90% of rural respondents was below 50,000 RMB while the annual income of nearly 90% of urban respondents was above this average level, which is in accordance with the significant economic disparity between rural and urban residents in China [81].

Table 1. Descriptive statistics of participant demographics.

	Rural		Urban	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender				
Female	176	36.4	228	54.3
Male	280	57.9	192	45.7
Missing	28	5.8	0	
Age				
Under 18	15	3.1	0	0.0
18–35	102	21.1	333	79.3
36–60	256	52.9	83	19.8
Over 60	96	19.8	4	0.9
Missing	15	3.1	0	
Annual Household Income				
Below 10,000 RMB	111	22.9	4	1.0
10,000 to 49,999 RMB	224	46.3	45	10.7
50,000 to 99,999 RMB	46	9.5	166	39.5
100,000 RMB and above	10	2.1	205	48.8
Missing	93	19.2	0	
Education				
Junior high school or below	376	77.7	1	0.2
High school	68	14.0	14	3.3
Undergraduate	3	0.6	367	87.4
Postgraduate and above	1	0.2	38	9.0
Missing	36	7.4	0	
In total	484	100.0	420	100.0

As another method of testing non-response bias, we also compared early-returned questionnaires to late-returned questionnaires using the variables of respondents' age, annual income, and education level. The results showed that late respondents and non-respondents shared similar characteristics and response biases, indicating that non-response bias is not a major problem in our dataset.

3.2. Measurement

The measurement of residential satisfaction in this study was adapted from PREQ developed by Sam, Bayram, and Bilgel [71] to better fit with the Chinese context. There are seven dimensions: (a) pollution and lack of green areas (five items were used to measure pollution, and only one item from the original measure was included to measure a lack of green areas as it is not common in rural China); (b) non-punctual transportation (one item was dropped from the five original items because of low factor loading); (c) punctual commercial services (all five original items were included); (d) opportunities (all four original items were included, and two new items were added); (e) adequacy of social and health services (five original items were included, and two items about services for elder peoples were deleted as this is not common in rural China); (f) adequacy of educational services (three original items were included, and one item was deleted because of low factor loading); (g) cultural-recreational services (four original items were included, and two items pertaining to movie theaters and libraries were deleted as they are rare in rural China). The measurement of place attachment was adopted from Kyle, Graefe, and Manning's [61] as well as Chen, Dwyer, and Firth's [56,57,62] evaluation-based place attachment dimensionality and scales. As for the scale of environmental satisfaction, Pelletier, Legault, and Tuson's [12] measure is applied for this study. All measurements were widely applied in different cultural contexts with high reliability, validity, and generalizability. For instance, the place attachment measuring was applied in both environmental psychology and tourism studies for instance in Australia, and China [56,57,62]. PREQ scales developed by Sam, Bayram, and Bilgel [71] were tested in Nigeria [82]. Pelletier, Legault, and Tuson's [12] measure on environmental satisfaction was also applied in China in several studies [83,84]. The details of the measure are presented in the Appendix A (Tables A1–A3).

Multiple-item, five-point Likert scales were adopted for all variables, with the lowest value "1" indicating "strongly disagree" and the highest value "5" indicating "strongly agree". A preliminary English version of the survey instrument, derived from a thorough literature review of constructs and measures, was translated into Chinese and back into English by two separate groups of researchers as a double check. Two stages of pretesting were conducted to determine the effectiveness of the questionnaire. In the first pretest, participants were aware that they were taking a pretest. They were asked to describe their reactions to the flow of the questions, explain whether the instrument was difficult to complete or understand, and even give their interpretation of some specific questions. After that, an undeclared test was carried out, with the survey administered just as we intended to conduct it in the field. The purpose of this was to ensure that respondents had no trouble following the instructions and enable us to examine the frequencies of the items and check whether there were too many non-responses. Finally, the feedback from the pretests was incorporated into a revised version of the survey instrument.

3.3. Reliability and Validity

A confirmatory factor analysis was conducted based on the calculation of Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE). The results indicated acceptable reliability (see Table 2). All items loaded highly on their respective latent constructs (0.539–0.950), all instances of Cronbach's α were higher than 0.79, and all CR scores were higher than 0.86 [85].

Table 2. Assessment of the reliability and validity of the measurement model.

Constructs and Items	Standard Loading	Weights	Cronbach's Alpha	CR	AVE
Environment satisfaction (ES)					
<i>Satisfaction with environmental conditions:</i>			0.937	0.955	0.843
ES1	0.935	0.289			
ES2	0.950	0.285			
ES3	0.941	0.280			
ES4	0.844	0.231			
<i>Satisfaction with government environmental policies:</i>			0.885	0.922	0.751
ES5	0.922	0.321			
ES6	0.937	0.317			
ES7	0.656	0.186			
ES8	0.918	0.310			
Residential satisfaction (RS)					
<i>Pollution and Lack of Green Areas (reversed):</i>			0.869	0.910	0.718
RS1	0.880	0.320			
RS2	0.800	0.253			
RS3	0.875	0.309			
RS4	0.831	0.295			
<i>Non-punctual services: transportation:</i>			0.851	0.888	0.664
RS5	0.814	0.249			
RS6	0.804	0.211			
RS7	0.857	0.274			
RS8	0.782	0.501			
<i>Punctual commercial services:</i>			0.856	0.896	0.636
RS9	0.658	0.179			
RS10	0.841	0.243			
RS11	0.823	0.225			
RS12	0.823	0.292			
RS13	0.826	0.305			
<i>Lifestyle (opportunities):</i>			0.857	0.893	0.585
RS14	0.747	0.193			
RS15	0.841	0.228			
RS16	0.837	0.253			
RS17	0.620	0.138			
RS18	0.742	0.275			
RS19	0.780	0.210			
<i>Adequacy of social and health services:</i>			0.798	0.863	0.563
RS20	0.584	0.197			
RS21	0.639	0.245			
RS22	0.879	0.305			
RS23	0.866	0.336			
RS24	0.737	0.230			
<i>Adequacy of educational services:</i>			0.841	0.904	0.758
RS25	0.863	0.374			
RS26	0.871	0.349			
RS27	0.877	0.425			
<i>Cultural-recreational services:</i>			0.877	0.915	0.730
RS28	0.848	0.322			
RS29	0.885	0.286			
RS30	0.878	0.310			
RS31	0.805	0.251			

Table 2. Cont.

Constructs and Items	Standard Loading	Weights	Cronbach's Alpha	CR	AVE
Place Attachment (PA)					
<i>Place Identity:</i>			0.907	0.935	0.782
PA1	0.888	0.289			
PA2	0.898	0.288			
PA3	0.882	0.278			
PA4	0.868	0.276			
<i>Place Dependence:</i>			0.850	0.901	0.700
PA5	0.888	0.311			
PA6	0.901	0.323			
PA7	0.908	0.344			
PA8	0.611	0.197			
<i>Affective Attachment:</i>			0.809	0.876	0.647
PA9	0.870	0.423			
PA10	0.884	0.438			
PA11	0.586	0.230			
PA12	0.539	0.203			
<i>Social Bonding:</i>			0.822	0.875	0.587
PA13	0.762	0.296			
PA14	0.823	0.290			
PA15	0.595	0.179			
PA16	0.828	0.284			
PA17	0.800	0.242			

Discriminant validity was examined by comparing the square root of AVE for each construct with the correlations between pairs of latent variables [86]. All correlation coefficients were smaller than the AVE square roots, shown in Table 3, with the exception of one. Specifically, for this exception the correlation between affective attachment and social bonding (0.771) was slightly higher than the AVE square root for social bonding (0.766), suggesting an acceptance level of discriminant validity.

Table 3. Testing discriminant validity.

Sqrt of AVE	EQS	EPS	NATU	TRAN	COM	LIFE	HEA	EDU	REC	PI	PD	AA	SB
EQS	0.918												
EPS	0.766	0.866											
NATU	0.776	0.693	0.847										
TRAN	0.375	0.452	0.449	0.815									
COM	0.098	0.249	0.238	0.485	0.797								
LIFE	0.122	0.252	0.268	0.519	0.604	0.765							
HEA	0.243	0.410	0.360	0.548	0.556	0.629	0.750						
EDU	0.192	0.283	0.348	0.278	0.599	0.439	0.473	0.871					
REC	0.265	0.413	0.352	0.516	0.632	0.572	0.721	0.572	0.854				
PI	0.431	0.481	0.525	0.288	0.371	0.449	0.485	0.487	0.477	0.884			
PD	0.426	0.500	0.530	0.289	0.297	0.399	0.428	0.481	0.412	0.749	0.837		
AA	0.341	0.372	0.445	0.250	0.383	0.409	0.380	0.529	0.397	0.732	0.764	0.804	
SB	0.303	0.349	0.398	0.278	0.391	0.430	0.382	0.490	0.376	0.651	0.676	0.771	0.766

Note: EQS = Satisfaction with environmental conditions; EPS = Satisfaction with government environmental policies; NATU = Pollution and lack of green areas (reversed); TRAN = Transportation; COM = Punctual commercial services; LIFE = Lifestyle (opportunities); HEA = Adequacy of social and health services; EDU = Adequacy of educational services; REC = Cultural-recreational services; PI = Place identity; PD = Place dependence; AA = Affective attachment; SB = Social bonding. The square root of AVE is shown on the diagonal of the matrix in bold; inter-construct correlation is shown off the diagonal.

4. Data Analysis and Results

This study applied a partial least squares (PLS)-based structural equation modeling (SEM) to test the aforementioned research hypotheses. The PLS-based approach was appropriate for this study for two main reasons. First, the PLS technique is robust and does not require data to be normally distributed [85,87,88]. Second, the PLS-based approach is superior to covariance-based SEM for

complex model testing [89]. The measurement and structural models in this study encompassed a large number of paths with considerable complexity. Specifically, there were 13 latent variables and three second-order constructs on a sample size of 904 (420 from urban areas in China and 484 from rural areas in China). This complex model was suitable for applying a PLS-based SEM approach. Accordingly, this study used the software SmartPLS (version 3.2.3) to perform its analyses. As suggested by Hair et al. [88], the researchers ran a standard PLS algorithm (1000 iterations and a stop criterion of 10^{-7}) and assessed the significance level of the estimates based on 1000 bootstraps.

4.1. Inner-Model Evaluation

For evaluating the structural model, effect sizes were calculated for the endogenous variables [55,85,90]. The full structural model was compared to models lacking each respective predicting construct to produce f^2 effect sizes. The value f^2 reflects the changes in the adjusted R^2 in relation to the unexplained variance of an endogenous variable [89]. The effect sizes of 0.02/0.15/0.35 were regarded as weak/moderate/strong [90].

The results are listed in Table 4 for the endogenous variables of place attachment and the four dimensions of place attachment. Some of the f^2 sizes for different dependent variables were close to zero, such as in residential satisfaction on place identity, suggesting these constructs were not relevant for directly explaining the variance observed. However, the f^2 effect size of environmental satisfaction on place attachment was 0.115 while that of residential satisfaction was 0.304, justifying their inclusion in the structural model testing [87,91,92]. Specifically, the effect size of environmental satisfaction on place attachment illustrates a weak but close to moderate effect, and that of residential satisfaction suggests a moderate but almost strong effect.

Table 4. f^2 effect sizes for endogenous variables.

f^2 Effect Size	PA	PI	PD	AA	SB
Adjusted R^2	0.408	0.787	0.801	0.830	0.749
Model without ES	0.115 ^w	0.005	0.005	−0.006	−0.004
Model without RS	0.304 ^m	0.000	−0.005	0.000	0.004

Note: ES = Environmental satisfaction; RS = Residential satisfaction; PA = Place attachment; PI = Place identity; PD = Place dependence; AA = Affective attachment; SB = Social bonding; ^w = weak effect; ^m = moderate effect; ^s = strong effect.

4.2. Hypotheses Testing

First, the potential impact of the variables of age, education, family size, gender, and income were examined on the targeted constructs. Significance levels were calculated on 1000 bootstrap samples [93] and no or only weak significant impacts were found (coefficients ranged from 0 to 0.2). Age had a negative effect on residential satisfaction ($\gamma = -0.067$, $p = 0.045$) but positive effects on environmental satisfaction ($\gamma = 0.112$, $p = 0.002$) and place attachment ($\gamma = 0.080$, $p = 0.040$). Education had no significant effects. Family size had a negative effect on residential satisfaction ($\gamma = -0.172$, $p = 0.000$) but a positive effect on environmental satisfaction ($\gamma = 0.199$, $p = 0.000$). As for gender, females tended to have higher environmental satisfaction ($\gamma = 0.083$, $p = 0.006$) but lower attachment to place ($\gamma = -0.067$, $p = 0.011$). Income had the opposite effects of age, with a positive impact on residential satisfaction ($\gamma = 0.191$, $p = 0.000$) and negative effects on environmental satisfaction ($\gamma = -0.206$, $p = 0.001$) and place attachment ($\gamma = -0.074$, $p = 0.028$).

Figure 1 summarizes the path coefficients of the relationships in the tested second-order structural model and the R^2 for the endogenous constructs. These relationships remained statistically significant after removing all the endogenous variables, suggesting a robust result of the hypothesized structural model. For the structural model, significance levels were calculated on 1000 bootstrap samples and t-statistics were calculated [94]. These statistics are listed in Table 5 for the second-order model testing. As is shown, environmental satisfaction had a direct effect on place attachment, which was positive and significant ($\gamma = 0.278$, $p < 0.001$). Furthermore, environmental satisfaction had a significant and

positive effect on residential satisfaction ($\gamma = 0.427$, $p < 0.001$), which in turn, had a significant and positive effect on place attachment ($\gamma = 0.469$, $p < 0.001$). The above results supported both H1 and H2. In particular, the first-order reflective factors of residential satisfaction, environmental satisfaction, and place attachment were all significant, which also confirmed the reliability of our measures.

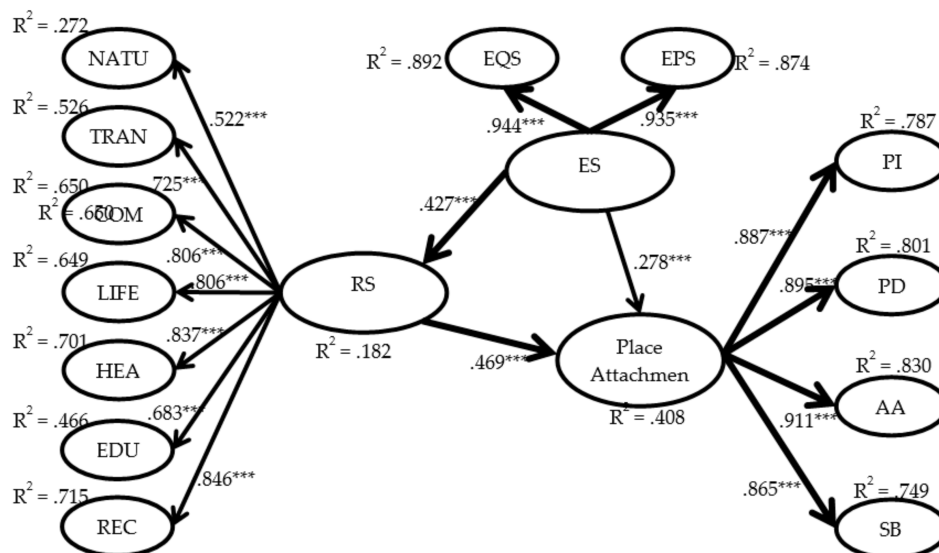


Figure 1. The result of structural equation model. Note: *** $p < 0.001$; EQS = Satisfaction with environmental conditions; EPS = Satisfaction with government environmental policies; ES = Environmental satisfaction; NATU = Pollution and lack of green areas (reversed); TRAN = Transportation; COM = Punctual commercial services; LIFE = Lifestyle (opportunities); HEA = Adequacy of social and health services; EDU = Adequacy of educational services; REC = Cultural-recreational services; PI = Place identity; PD = Place dependence; AA = Affective attachment; SB = Social bonding; RS = Residential satisfaction.

Table 5. Second-order model testing for estimates, t-statistics, and 95% bias corrected confidence intervals.

	Estimates	T-Statistics	95% BC CI	
			2.50%	97.50%
ES → Place Attachment	0.278 ***	7.043	0.201	0.354
ES → RS	0.427 ***	14.230	0.370	0.486
RS → Place Attachment	0.469 ***	14.110	0.403	0.537
ES → RS → Place Attachment	0.200 ***	8.976	0.158	0.246
ES → EPS	0.935 ***	109.567	0.920	0.951
ES → EQS	0.944 ***	164.746	0.932	0.954
Place Attachment → AA	0.911 ***	107.162	0.894	0.926
Place Attachment → PD	0.895 ***	67.918	0.870	0.920
Place Attachment → PI	0.887 ***	84.442	0.867	0.907
Place Attachment → SB	0.865 ***	65.731	0.835	0.888
RS → COM	0.806 ***	46.800	0.766	0.839
RS → EDU	0.683 ***	31.090	0.641	0.726
RS → HEA	0.837 ***	51.459	0.793	0.860
RS → LIFE	0.806 ***	52.970	0.771	0.831
RS → NATU	0.522 ***	18.207	0.469	0.579
RS → REC	0.846 ***	76.400	0.826	0.868
RS → TRAN	0.725 ***	35.568	0.682	0.762

Note: *** $p < 0.001$; EQS = Satisfaction with environmental conditions; EPS = Satisfaction with government environmental policies; ES = Environmental satisfaction; NATU = Pollution and lack of green areas (reversed); TRAN = Transportation; COM = Punctual commercial services; LIFE = Lifestyle (opportunities); HEA = Adequacy of social and health services; EDU = Adequacy of educational services; REC = Cultural-recreational services; PI = Place identity; PD = Place dependence; AA = Affective attachment; SB = Social bonding; RS = Residential satisfaction.

Research has suggested the use of confidence intervals to investigate mediating effects [89,95]. Accordingly, an indirect relationship testing was applied in the PLS based on 1000 bootstrap samples, and the results were consistent with the proposition on the mediating effect of perceived residential environment quality: for this indirect relationship, $\gamma = 0.200$, $p < 0.001$, $t = 8.976$, bias-corrected confidence interval was of (0.158, 0.246). Hence, H3 was supported. Also, from a post-hoc analysis removing residential satisfaction, the f^2 effect size reflecting the changes in R^2 (illustrated in Table 4) is 0.304, indicating a moderate (close to strong) effect of residential satisfaction in the structural model. This result again confirms that residential satisfaction plays a mediating effect between environmental satisfaction and place attachment [87,92].

4.3. Post hoc Multi-Group Analysis

The study population was divided into two groups by the location of data collection: rural areas and urban areas. A three-step procedure analyzing measurement invariance of composite models (MICOM) was applied to test: (1) configural invariance, (2) compositional invariance, and (3) the equality of composite mean values and variances [96,97]. From this analysis, no composite has a correlation in urban and rural group that is significantly lower than one, suggesting compositional invariance being established. Furthermore, all the permutation-based confidence intervals of differences in mean values and logarithms of variances between the construct scores of the two groups include the obtained differences, suggesting equal composite mean values and variances. Via this three-step permutation procedure, sufficient evidence was provided that the observed scale indicators/items under study measured the same theoretical constructs across the two groups of the sample [96].

To test whether the structural model differed in each group, this study conducted a multi-group analysis to calculate 95% bias-corrected bootstrap intervals in order to compare rural to urban sub-samples [98,99]. The calculation is based on a 1000 bootstrap run. There is no significant difference between the overall model and the rural and urban models (see Table 6). As for the differences between urban and rural samples, a number of significant differences were found. First, the relationship from environmental satisfaction to residential satisfaction was significantly stronger for the rural sample, and that from residential satisfaction to place attachment was significantly stronger for the urban sample. Second, residential satisfaction was more significantly reflected in education, health, lifestyle, and recreation in the urban sample while more in nature in the rural sample. Environmental satisfaction, on the other hand, was more significantly reflected in the environment policy satisfaction in the urban sample.

A further first-order group analysis was conducted to compare rural to urban sub-samples, and several significantly different direct and indirect relationships were found as follows. (1) The effects of environment quality satisfaction on different aspects of residential satisfaction were generally positive in the rural sample, resulting in a significant difference in these relationships. (2) Transportation had a significant negative impact on place identity in the rural sample, but this relationship was not significant in the urban sample. (3) Education more significantly impacted affective attachment and place dependence in rural areas than in urban areas. (4) Environment policy satisfaction had more significant indirect impacts on dimensions of place attachment in urban areas. (5) Environment quality satisfaction had significant indirect effects on dimensions of place attachment in rural areas, while no significant indirect relationships were found in the urban areas.

Table 6. Second-order model group analysis for estimates and 95% bias corrected confidence intervals for comparisons between rural and urban groups.

	Urban – Rural				Rural				Urban			
	<i>t</i> Value				95% BC CI				95% BC CI			
	Estimates	PLS = MGA <i>p</i> Value	Parametric	Welch- Satterthwait	Estimates	T-Value	2.50%	97.50%	Estimates	T-Value	2.50%	97.50%
ES → PA	n.s.	0.332	0.397	0.414	0.167 **	1.989	0.035	0.355	0.206 ***	4.648	0.112	0.290
ES → RS	0.320 ***	1.000	6.142	5.902	0.695 ***	29.018	0.635	0.735	0.376 ***	7.730	0.262	0.458
RS → PA	0.138 *	0.035	1.735	1.79	0.464 ***	7.240	0.319	0.571	0.602 ***	14.001	0.519	0.689
ES → RS → PA	n.s.	0.950	1.589	1.634	0.323 ***	6.714	0.223	0.405	0.226 ***	6.585	0.157	0.293
ES → EPS	0.063 ***		3.404	3.601	0.883 ***	53.394	0.850	0.912	0.946 ***	155.883	0.934	0.958
ES → EQS	0.033 *	0.024	1.695	1.774	0.903 ***	54.903	0.873	0.928	0.935 ***	112.568	0.918	0.951
PA → AA	0.034 *	0.985	2.176	2.137	0.925 ***	99.342	0.900	0.939	0.891 ***	68.796	0.862	0.913
PA → PD	n.s.	0.242	0.696	0.726	0.893 ***	50.037	0.852	0.921	0.907 ***	94.665	0.887	0.925
PA → PI	0.057 *	0.995	2.651	2.596	0.901 ***	72.812	0.878	0.925	0.845 ***	46.742	0.806	0.878
PA → SB	0.082 **	0.999	3.149	3.085	0.890 ***	58.676	0.852	0.914	0.808 ***	36.817	0.762	0.848
RS → COM	n.s.	0.903	1.315	1.27	0.828 ***	44.167	0.786	0.86	0.778 ***	22.518	0.705	0.839
RS → EDU	0.098 *	0.006	2.456	2.453	0.659 ***	24.480	0.606	0.71	0.757 ***	25.784	0.697	0.811
RS → HEA	0.072 **	0.001	2.874	2.969	0.821 ***	40.216	0.753	0.848	0.893 ***	67.041	0.862	0.915
RS → LIFE	0.105 ***		4.333	4.508	0.793 ***	39.320	0.747	0.828	0.898 ***	78.022	0.871	0.917
RS → NATU	0.211 ***	1.000	4.437	4.291	0.692 ***	28.896	0.645	0.739	0.481 ***	11.203	0.389	0.557
RS → REC	0.067 **	0.000	3.412	3.487	0.822 ***	54.032	0.791	0.851	0.889 ***	74.640	0.864	0.911
RS → TRAN	n.s.	0.064	1.538	1.536	0.735 ***	31.407	0.685	0.774	0.789***	30.578	0.731	0.831

Note: * $p < 0.1$, ** $p < 0.01$, *** $p < 0.001$; EQS = Satisfaction with environmental conditions; EPS = Satisfaction with government environmental policies; ES = Environmental satisfaction; NATU = Pollution and lack of green areas (reversed); TRAN = Transportation; COM = Punctual commercial services; LIFE = Lifestyle (opportunities); HEA = Adequacy of social and health services; EDU = Adequacy of educational services; REC = Cultural-recreational services; PI = Place identity; PD = Place dependence; AA = Affective attachment; SB = Social bonding; RS = Residential satisfaction; PA = Place attachment.

5. Discussion, Conclusions and Implications

This study has proposed a theoretical framework to capture the relationships between environment satisfaction, residential satisfaction, and place attachment from the perspective of the resident. A second-order structural model was constructed and tested using a sample of both rural and urban residents in China. It was found that environmental satisfaction has an indirect positive effect on place attachment, via the mediating effect of residential satisfaction.

In addition, when separating the rural and urban samples, significant differences in the relationship of “environmental satisfaction-residential satisfaction-place attachment” were observed, indicating a systemic difference in the psychology of rural and urban populations. While environmental satisfaction had a significant impact on residential satisfaction in both urban and rural areas in China, the impact was more significant in rural areas than in cities. This suggests that satisfaction with their environmental conditions plays an important role for residents of rural areas of China. In addition, the impact of residential satisfaction on place attachment was more significant in urban areas. Currently, China is experiencing an accelerating rate of urbanization as result of migration to urban regions [100,101]. This may well be the key reason why place satisfaction affects urban residents’ attachment to a given place to a greater extent than it does rural residents’: it is easier for urban residents to migrate between urban regions; thus, their attachment to their resident place is more dependent on their level of satisfaction with it.

Simply put, urban residents’ attachment to a given place was more influenced by residential satisfaction than by environment satisfaction, while rural residents’ environment satisfaction affected their attachment to the place through both direct and indirect effects, with residential satisfaction as the mediator. This is consistent with the reality that other aspects of the residential environment play roles that are more important in urban residents’ attitude toward a place. The implications are substantial yet different for urban and rural government authorities. Local governments in rural areas of China should focus on the improving environmental qualities to strengthen residents’ attachment to the place. For example, they can put more efforts into facilitating transportation connectivity and access, enhancing the level of social services and generating employment opportunities. In urban areas of China, on the other hand, governments need to explicitly enhance residents’ satisfaction for a given place as well as improve overall environmental quality. For example, they can invest more in increasing greenspace, improving public transport and reducing pollution levels. In summary, both urban and rural government will need to improve amenity values however the nature of such amenities will potentially differ according to local circumstances and population profiles [102]. Nevertheless, a range of actions to strengthen place attachment will likely be required to make locations “sticky”, attract, and retain populations.

In examining the effects of environmental satisfaction in the first-order structural model, we found that satisfaction with environmental conditions had impacts on both place identity and affective attachment, while satisfaction with government environmental policies had an impact on place dependence alone. This is consistent with Moser’s [78] proposition on residential satisfaction’s mediating effect on person-environment congruity and suggests the importance of environmental conditions on the cognitive and affective aspects of residents’ relationship with a place. The implication is that the actual environmental conditions form the residents’ subjective and emotional connection to the place, and any modifications to these conditions may affect residents’ attachment to place. However, in the urban context, the actual environmental conditions had a very limited influence on residents’ attachment to the place.

Pollution and a lack of green areas were found to significantly influence residents’ satisfaction toward their place in both urban and rural areas of China, indicating a high level of awareness of the importance of the environment. This is consistent with the findings of past studies examining the effect of perceived residential environment quality on attachment [9,35]. This concern among Chinese citizens calls for future research on understanding the role of the resident in environmental

and sustainable urbanization, as well as exploring new techniques for reducing pollution and new approaches for evaluation [6,103].

Interestingly, improvements in the transportation system have led to a decrease in place identity, especially in rural areas of China. It is reasonable that convenient transportation that connects different regions can reduce rural residents' dependence on their local rural areas, as they are not necessarily bound to one place [104]. In fact, the development of transportation in the country (such as China's high-speed railway) has been an important driver for urbanization in and of itself. This study further finds that adequacy of educational services is not a key factor affecting residents' satisfaction toward a given place but is an important indicator of their attachment to the place in rural areas of China.

6. Limitations

Educational issues in China are relatively complex and require examination beyond the scope of this study. Improving educational services in the study regions may help local governments retain residents by strengthening their attachment to their respective regions. This said, education was not found to have a significant impact on any construct included in this study in terms of the overall sample, but the huge variance between rural and urban samples might be another reason leading to the systematic differences between rural and urban models. Therefore, this remains a limitation of this study and suggests the need for future research. This limitation also applies to the huge variance in age in the urban and rural samples of this study.

Another limitation of this study is that length of residence (often considered an important variable in environmental studies) is not emphasized here. Therefore, issues regarding length of residence require further examination especially in areas that have experienced large-scale in-migration.

This paper provides empirical evidence from a specific context (urban and rural China). It would be promising for future research to examine more individual physical and social factors, such as years of residence, collective efficacy, and criminal history, which have been shown to play a role in place attachment [105]. Studying the dynamics of residents' psychology and behavior related to the environment can potentially provide a unique perspective for exploring and discussing urban planning issues.

Finally, although we attempted to obtain a valid sample for this study, there were still some limitations in the sampling process, and improvements are required in future studies. For the rural sample, we choose only two typical provinces and several villages there. Future studies should select more areas and try to confirm the results in a larger sample. For the urban sample, as we collected data with an online survey agent, the response rate was quite low, potentially causing sampling bias issues. Although the non-response tests showed that this was not a problem, future studies should aim to increase the response rate, for example, by applying a more appropriate survey technique to prevent non-response.

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Appendix A

Table A1. Environment Satisfaction (ES).

<i>Satisfaction with environmental conditions:</i>
ES1. The local environmental conditions are excellent.
ES2. In most ways, the environmental conditions in my area are close to the ideal.
ES3. So far, I am content with the state of the environment in my area.
ES4. If I could change some aspect of the environmental condition in my area, I would change almost nothing.
<i>Satisfaction with government environmental policies:</i>
ES5. In most ways, the quality of the government's environmental programs is very good.
ES6. The government policies developed to deal with the environmental situation are excellent.
ES7. For the most part, the programs developed by the government have addressed the most important environmental problems.
ES8. In my opinion, the amount of attention given to the environment by the government has been satisfactory.

Table A2. Residential Satisfaction (RS).

<i>Pollution and Lack of Green Areas (reversed):</i>
RS1. The air in the neighborhood is very clean.
RS2. There is not too much noise in the neighborhood.
RS3. The road in the neighborhood is clean.
RS4. There are many green areas in the neighborhood.
<i>Non-punctual services: transportation:</i>
RS5. The existing public transportation guarantees good connections with other parts of the city/town.
RS6. There is enough choice of public transportation in the neighborhood.
RS7. The buses in the area are often too inconvenient.
RS8. The buses in this neighborhood are not overcrowded.
<i>Punctual commercial services:</i>
RS9. This is a very commercial area, well-furnished with stores.
RS10. There are all kinds of stores in the neighborhood.
RS11. The neighborhood has a convenient local market.
RS12. The stores in the neighborhood are also meeting places for the inhabitants.
RS13. The majority of things could be bought in the stores in this neighborhood.
<i>Lifestyle (opportunities):</i>
RS14. This neighborhood is not only a dormitory.
RS15. Many things can be done in this neighborhood.
RS16. Young people tend to stay in this neighborhood.
RS17. It is a neighborhood with many points of interest.
RS18. It is easy to communicate and get information in the neighborhood.
RS19. There are many training programs in the neighborhood.
<i>Adequacy of social and health services:</i>
RS20. There is a hospital that can be easily reached from the neighborhood.
RS21. The local health office in this area offers better services compared with others.
RS22. The neighborhood is well-equipped for medical tests and outpatient services.
RS23. The neighborhood is well-furnished with social services.
RS24. The municipal offices in the area respond adequately to the needs of the neighborhood.
<i>Adequacy of educational services:</i>
RS25. The neighborhood schools are generally good.
RS26. Schools and nurseries in the neighborhood are often held in suitable places.
RS27. Children and young people in neighborhood schools live in the area.
<i>Cultural-recreational services:</i>
RS28. The already functioning cultural canterers satisfy the needs of this neighborhood.
RS29. You can always find a place to spend free time in this neighborhood.
RS30. There are many social activities.
RS31. The existence of a meeting place would gather around many of the young people of the neighborhood.

Table A3. Place Attachment (PA).

<i>Place Identity:</i>
PA1. I strongly identify this neighborhood.
PA2. I feel commitment to this neighborhood.
PA3. I feel that I can really be myself in this neighborhood.
PA4. This neighborhood is very special to me.
<i>Place Dependence:</i>
PA5. I cannot leave this neighborhood.
PA6. I prefer this neighborhood over others for what I want.
PA7. This neighborhood is my favorite place to be.
PA8. This neighborhood is better than any other place.
<i>Affective Attachment:</i>
PA9. I really miss this neighborhood when I am away from it for too long.
PA10. This neighborhood means a lot to me.
PA11. I feel a strong sense of belonging to this neighborhood.
PA12. I have emotional attachment to this neighborhood.
<i>Social Bonding:</i>
PA13. I have a special connection to this neighborhood and the people here.
PA14. My friends/family would be disappointed if I were to move from this neighborhood.
PA15. If I were to leave this neighborhood, I would lose contact with a number of friends.
PA16. Many of my friends/family prefer this neighborhood over others.
PA17. I have friends/family in this neighborhood.

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