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Carbon Neutrality Goal Is Too Far Away? Residents' Psychological Distance of Low-Carbon Policy Over Time and Space in China

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Abstract: Residents' psychological time and space distance from the low-carbon policy can affect their support for the policy. The objective of this study is to investigate the psychological spatiotemporal distance of Chinese residents toward low-carbon policies and its influencing factors. Structural equation modeling was used in this study. Based on the data from the questionnaire survey, we found that most of the interviewed residents had a psychological time distance of 21–30 years for low-carbon policies, while the spatial distance was in the "global" range. Therefore, the goal of achieving carbon neutrality by 2060 exceeds the psychological time distance of the interviewed residents. The results of the structural equation model showed that residents' psychological time distance toward low-carbon policies is significantly and positively correlated with policy effects, policy costs, and residents' low-carbon values and attitudes. Residents' psychological spatial distance to low-carbon policies was significantly and positively correlated with the effects of low-carbon policies and residents' low-carbon values and attitudes.

Keywords: low-carbon policy, psychological distance, low-carbon awareness, policy support, low-carbon city

1. Introduction

Residents experience psychological distance from policies related to climate change, including psychological time distance and psychological space distance. Climate change is a long-term and slow process that people think is too long and likely to exceed their life expectancy. Therefore, there is a psychological time distance to a particular policy. Spatial distance arises because it is difficult for people to intuitively perceive global climate change. They tend to judge changes in their neighborhoods or familiar landscapes. The costs of climate change in regions far away from space are often not felt [1]. It is the existence of these distances that directly affects the degree of people's support for climate change policies, such as low-carbon policies [2]. To address the challenges posed by climate change, China has formulated a series of policies to address climate change [3] and has pledged to achieve carbon neutrality by 2060. To achieve this goal, China has formulated many policies requiring the support of residents, for example, policies encouraging the purchase of new energy vehicles, low-carbon travel, and energy conservation. However, if residents think that the carbon neutrality goal is too far from them, a psychological distance in time and space exists, which can affect their level of support. The reduction in residents' support level is not conducive to the realization of the carbon neutrality goal; therefore, it is of great value to study the psychological space-time distance of residents toward low-carbon policies.

Qualitative studies have shown that psychological distance is important for people's mental representation of climate change [4]. The psychological temporal distance to climate change can be expressed in terms of years [5]. A decrease in psychological distance leads to an increase in specific emotions, such as fear, while an increase in psychological distance leads to an increase in hope [6]. Psychological distance significantly influences public preferences for environmental policies, with closer psychological distance making the public more supportive of such policies [7]. The more distant climate change is perceived in time and space, the less support the corresponding policy achieves [8].

Therefore, this study investigates the psychological distance between residents and low-carbon policies. In particular, an empirical analysis of the factors affecting these distances is not only conducive to assessing residents' psychological space-time distance but also to formulating targeted policies. These policies can inspire residents to support carbon neutrality goals and contribute to sustainable global development. In addition, as mentioned in the second part, based on the survey data of Chinese residents, to the best of our knowledge, no prior research has analyzed the psychological space-time distance of residents. Due to this research gap, we selected Chengdu, a low-carbon pilot city in China, as the survey site and conducted an empirical analysis of residents' psychological space-time distance and its influencing factors. This is the main contribution of the study.

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This paper is structured into the following sections to analyze residents' psychological distance to low-carbon policies. The first part is the introduction, followed by the literature review and hypothesis in the second section. The third section presents the research methodology, while the fourth section discusses the results and analysis. The fifth section presents the conclusion, and the final section provides recommendations.

2. Literature Review and Hypothesis

Significant research has been conducted to examine individuals' perceptions and attitudes toward environmental and climate change-related policies, especially on the psychological space-time preferences of these policies. These can be divided into the following aspects.

2.1. Influencing factors

Existing studies have analyzed psychological spatial distances, including local, national, and global distances. The results for the three levels indicate temporal pessimism and spatial optimism biases [9]. Many studies have shown this temporal preference for residents' spatial psychological distance to be distant from their temporal psychological distance, such as those by Keller et al. [4], Gubler et al. [10], Wang et al. [11], and Lee and Barnett [12]. However, it has also been found that residents are more sensitive to spatial psychological distance than temporal psychological distance [5]. This may be due to differences in age and occupation of the participants in different studies; for example, the latter study group included farmers who were more closely associated with the climate [5]. In terms of the relationship with policy, a closer psychological distance is positively associated with support for policy [13]. Greater temporal and spatial distances reduce the likelihood of policies being chosen [14]. A shorter psychological distance is associated with greater attention [1]. Research from New Zealand showed that considering local adaptations could affect residents' psychological spatiotemporal distance, which in turn increases their supportive behavior [15]. Residents tend to pay more psychological attention to their areas [16]. As early as 1991, Pawlik [17] demonstrated the influence of information on psychological characteristics. Meanwhile, the expression of information can also affect residents' psychological space-time distance; for example, where information is described as being spatially close, residents' awareness of climate change can increase [18]. This information also includes various forms of spatiotemporal discounting [19]. Delays in policy benefits over long periods can affect residents' behavior. The main reason for this is long-term uncertainty, especially regarding long-term political commitments [20]. Based on these findings, we propose the following hypothesis:

H1: Residents' psychological space-time distance to low-carbon policies is significantly related to policy results and costs.

Additionally, the individual characteristics of residents affect their psychological space-time distance, such as culture, world view, environmental values [18], and personal experiences [21]. In light of this background, the authors propose the following hypothesis.

H2: Residents' psychological space-time distance toward low-carbon policies is significantly related to their low-carbon values and attitudes.

The consequences of environmental risks can lead to different behavioral tendencies among residents [22], including differences in the causal structure of environmental and other risks [23].

2.2. Research method used

Existing research has used a variety of methods, both quantitative and qualitative [19]. As it involves the psychological behavior of residents, sampling interviews have become a mainstream research method, such as those of Trope and Liberman [1], Evans et al. [15], Wang et al. [11], Arnout [24], and Moon et al. [25]. In addition, behavioral experimental research on residents is also one of the methods used [18, 26]. After collecting resident data, existing studies have mostly used quantitative analysis methods [27].

2.3. Countermeasures

Existing studies have also proposed countermeasures to guide residents' psychological space-time distance and risk communication technology aimed at reducing psychological distance [1]. There are also research recommendations for guiding the public's long-term preferences [28]. Climate communication, defined as reducing psychological distance, is a strategy used to increase public participation in climate change [27]. Weber [29] recommended the use of an instinctive response to address the risks associated with global warming, for example, by simulating a post-climate change disaster scenario in which residents' homes or familiar areas are impacted by climate change.

2.4. Contribution

Examining the factors that influence residents' psychological distance to low-carbon policies provides valuable insights into their perceptions and can guide the development of effective low-carbon policies. Therefore, this study contributes to a better understanding of residents' psychological distance to low-carbon policies, which can inform policy formulation. Low-carbon policies with a popular base might contribute more quickly and effectively to China's move toward carbon neutrality and thus to the global process of carbon neutrality and sustainable development. In addition, as a major factor affecting low-carbon targets, the psychological distance between residents in terms of time and space has not been explicitly measured in China. This study aims to fill this gap and contribute to the measurement and analysis of the psychological distance of low-carbon policies for Chinese residents. Inspired by the aforementioned studies, the motivation was to examine the psychological spatiotemporal distance of Chinese residents toward low-carbon policies and the influencing factors.

3. Research Methodology

3.1. Research site

We chose Chengdu, China, as the research area. Chengdu is located in southwest China, west of the Sichuan Basin, and has developed industries. Chengdu has been designated as a pilot city for the development of a low-carbon city by the Chinese government. On March 14, 2023, the State-owned Assets Supervision and Administration Commission of the State Council of China and the Chongqing Municipal Government signed the

"Strategic Cooperation Framework Agreement on Central-Local Cooperation to Promote the Construction of the Twin-City Economic Circle in the Chengdu-Chongqing Region," The Chinese government intends to build a low-carbon, green economic circle with high-quality development, which elevated Chengdu's status even more in the country. Meanwhile, the Chengdu Municipal Government has formulated low-carbon development plans. For example, by 2025, the proportion of clean energy in the city's total energy consumption will increase to more than 68.5%, and the proportion of non-fossil energy consumption will reach 50.5%. The successful realization of these goals requires the support of residents. Therefore, it is necessary to study the psychological space-time distance of residents toward low-carbon policies. Influencing factors were identified, and targeted guiding policies were formulated to promote the realization of Chengdu's carbon neutrality goal. The four provinces of Sichuan, Chongqing, Guizhou, and Yunnan are closely related geographically and form the main area of the Southwest Official Dialect [30]. The cultural concepts and ways of thinking reflected in their dialects influence people's sense of belonging and identification with each other in terms of identity and psychology [31]. The Southwest official dialect area can be viewed as a cohesive region with shared cultural characteristics. [32]. Psychological distance is related to factors such as identity, worldview, and cognitive style [4]. Therefore, the findings on the psychological distance of Chengdu residents have implications for Yunnan, Guizhou, Sichuan, and Chongqing. Southwest China accounts for approximately 32% of the CO2 uptake of mainland China [33]. Southwest China is the largest carbon sink region in the country [34, 35]. Therefore, it should receive more CO2 quotas [36]. The Southwest is a major contributor to China's carbon neutrality goal and plays an overall important role. Therefore, we demonstrate that the conclusions of this study can be applied to large-scale areas.

3.2. Questionnaire design

Based on existing research, we designed a draft of the questionnaire, including the following parts: (1) Basic information, including gender [37, 38], age [39], education level [40], and personal income [41]. (2) Psychological space-time distance. Time distance (in ten years) was used for design, while spatial distance was measured by city, province, China, and the world [9]. The answers were graded using a five-point equidistant method, such as AT2 or AT3; they were all single choices. (3) Influencing factors include policy results, policy costs [14], low-carbon values [42], and attitudes [43]. Points were assigned using a five-point equidistant scale. (4) Open-ended questions included questions on whether there were other influencing factors. A draft of the questionnaire was tested by our research group. Deficiencies that appeared on the test, such as unclear question expressions, were corrected. The revised questionnaire framework is presented in Table 1.

3.3. Questionnaire distribution

The urban areas of Chengdu include 12 districts: Jinjiang, Qingyang, Jinniu, Wuhou, Chenghua, Longquanyi, Qingbaijiang, Xindu, Wenjiang, Shuangliu, Pidu, and Xinjin. Therefore, using cluster sampling, Chengdu was divided into 12 blocks. The residents in each block were then contacted as interim investigators by students, colleagues, and friends. These ad hoc investigators were trained using WeChat and a phone.

Questionnaires were stored on a Questionnaire Star platform in the form of electronic data. The platform can generate a QR code for the questionnaire, scan the QR code to fill in the questionnaire, and automatically store the results on the Questionnaire Star platform. Temporary investigators ($n = 12$) in each block had a QR code and completed at least 20 street-intercept interviews. Temporary investigators showed the QR code to the participants and allowed them to scan and fill in the answers directly with their mobile phones, or the investigators read the questions to the participants and entered the answers directly into their mobile phones for submission.

A total of 240 questionnaires were recovered, of which 195 were valid. Among the residents interviewed, women accounted for 59.49%. Residents aged 18–35 years accounted for 75.90% of respondents. More than half of the respondents had a university education, which might be due to the high concentration of universities in the urban area of Chengdu. In addition, according to the National Bureau of Statistics of China, the percentage of the higher-education population in Chengdu is 25.6%, which is higher than the national percentage of the higher-education population of 17.0%, indicating that the population in Chengdu has a high level of higher education (see Table 2). All data presented in the tables below were obtained from the questionnaire data.

3.4. Reliability and validity

There is no unified method for calculating the reliability and validity of a questionnaire, and different calculation methods can be selected according to the needs of the specific research. Nonetheless, alpha coefficients and dimensional and global scores have been widely and successfully used to calculate questionnaire reliability and validity. According to the questionnaire data, the alpha coefficient is between 0.60 and 0.80. The correlation coefficients for each dimension are significantly correlated at the 0.01 level (two-tailed). Therefore, the questionnaire has adequate reliability and validity [44]. Questionnaire data were used to construct the model (Table 3).

4. Results and Analysis

The psychological time distance of residents toward low-carbon policies ranged between 21–30 years. According to the scoring principle of the five-point equidistant method, we calculated the residents' psychological time-distance scores for low-carbon policies. The results indicated that residents' psychological time distance toward low-carbon policies had the highest score at 21–30 years (651), and the average score was also the highest (3.34). Most interviewed residents positioned the psychological time distance of low-carbon policies to be between 21–30 years. Both too-short (1–10 years) and too-long (>41 years) time distances scored low, at 576 and 542, respectively. This result echoes the respondents' conclusion that global warming will have a serious impact on humans within 25–50 years [45]. The population wants to achieve carbon neutrality goals before global warming has a serious impact on their health. As mentioned above, many factors affect residents' psychological time distance from policies. If the policy implementation cycle is too long, it will easily lead to increased uncertainty, whereas if the policy implementation cycle is too short, the effect will not appear immediately. Therefore, a psychological time distance of 21–30 years is appropriate. China's 2060 carbon neutrality target appears to be too long for the interviewed residents. Especially for residents who are used to short-term decisions. (See Figure 1). All figures below were drawn by us based on the questionnaire data.

Table 1
Framework of the revised questionnaire

Time and space distance. Some low-carbon policies have a period of several decades, such as carbon neutrality in 2060. Please answer the questions below according to your thoughts, thank you.	
The time span of the carbon neutrality goal should be (Year)	Very disagree —> Very agree
TS1:1-10	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
TS2: 11-20	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
TS3: 21-30	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
TS4:31-40	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
TS5: Over 41	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
The spatial scope of carbon neutrality should be in	
SS1: Your city	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
SS2: Your province	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
SS3: China	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
SS4: Worldwide	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
Policy results	References
PR1: Reduce man-made carbon emissions	Jacobs and Matthews [20]
PR2: Mitigate the consequences of climate change	
PR3: The ecological environment is more beautiful	
Policy costs	Sparkman et al., [14]
PC1: inconvenience to life	
PC2: lower GDP	
PC3: cause unemployment	
Value	Liu and Bai [42]; Chu and Yang [18]
VA1: Concerns about low-carbon issues are mainly due to concerns about social development or human survival.	
VA2: Concerns about low-carbon issues are mainly due to the consideration of protecting the natural environment	
Attitude	Liu and Bai [42]; Peng [43]
AT1: Human beings have the right to change the natural environment to suit their needs.	
AT2: Human ingenuity can ensure that the greenhouse effect problem is solved.	
AT3: Nature's ability to balance itself is sufficient to cope with the effects of greenhouse gas emissions.	
AT4: The media coverage of carbon emissions often makes me very angry.	

Table 2
Descriptions of interviewees' basic information

Demographic characteristics		%
Gender	Male	40.51
	Female	59.49
Age	18–35	75.90
	36–59	22.56
	≥50	1.54
Education level	High school and below	5.13
	College	51.28
	Postgraduate and above	43.59
Incomes (RMB/monthly)	≤3000	38.46
	3001–5000	24.10
	5001–10,000	26.67
	≥10,001	10.77

The psych-spatial distance score for residents towards low-carbon policies was highest for the option with a "Global" perspective. The option with global psych-spatial distance received the highest score of 773 among the four available options, while the option with China as the psych-spatial distance received the second-highest score of 711. The province was the option with the lowest psych-spatial distance score of 653. This corroborates the findings of the previous studies that the residents' perceptions of the effects of global warming and climate change are global, as demonstrated by Katz et al. [45] and Berger et al. [46]. The public's spatial psychological distance and spatial perception of climate change are global [5, 47]. The implementation of policies to reduce greenhouse pollution will only show long-term benefits at the global level [48]. These results show that the interviewed residents had a broad spatial scope for low-carbon policies and considered them from a global perspective. Part of this is related to the promotion of low-carbon policies in China. In advocacy involving low-carbon policies and carbon neutrality goals, China's perspective is almost always globally emphasizing global climate change and China's global contribution to carbon neutrality goals. A few advocacies began with a single city or province (see Figure 2).

Most respondents believed that low-carbon policies are effective. More than 80% of respondents agreed or strongly agreed that low-carbon policies have positive effects. In particular, 90% of respondents believed that low-carbon policies could make the ecological environment more beautiful. Research continues to demonstrate the dramatic effects of low-carbon policies [49].

Table 3
Results of validity and reliability

	Coefficients' dimensional scores	Coefficients' global scores	α
Time distance			0.604
TS1	0.542**	0.489**	
TS2	0.609**	0.494**	
TS3	0.650**	0.416**	
TS4	0.719**	0.466**	
TS5	0.612**	0.429**	
Space distance			0.755
SS1	0.834**	0.608**	
SS2	0.893**	0.626**	
SS3	0.861**	0.569**	
SS4	0.424**	0.373**	
Policy results			0.829
PR1	0.848**	0.567**	
PR2	0.899**	0.519**	
PR3	0.853**	0.486**	
Policy costs			0.847
PC1	0.827**	0.369**	
PC2	0.893**	0.369**	
PC3	0.888**	0.321**	
Value			0.768
VA1	0.904**	0.460**	
VA2	0.898**	0.518**	
Attitude			0.780
AT1	0.815**	0.494**	
AT2	0.819**	0.581**	
AT3	0.837**	0.503**	
AT4	0.625**	0.492**	

**Correlation is significant at the 0.01 level (two-tailed).

Low-carbon policies have reduced greenhouse gas emissions and other environmental pollution [50]. However, over 30% of the respondents strongly disagreed or disagreed with the costs of low-carbon policies. However, it is worth noting that more than 40% of the respondents chose a neutral response. More than 20% of the respondents agreed or strongly agreed with the costs of low-carbon policies (Table 4).

Table 4
Residents' response to the effects and costs of low-carbon policies

	Very disagree	Disagree	Neutral	Agree	Very agree
PR1	1.54%	0.51%	12.82%	50.77%	34.36%
PR2	1.03%	1.54%	8.72%	46.67%	42.05%
PR3	1.03%	0.51%	8.21%	45.13%	45.13%
PC1	4.1%	29.74%	42.05%	15.9%	8.21%
PC2	4.1%	29.23%	44.61%	15.9%	6.15%
PC3	6.67%	34.36%	41.03%	13.33%	4.62%

A high low-carbon value score and neutral low-carbon attitude coexisted. The average score of the respondents on the low-carbon value dimension was above 4.00 (out of 5). Respondents had high low-carbon values. However, in terms of respondents' low-carbon attitudes, the average score was approximately 3.00 (out of 5). Significant differences were observed between the two groups. The low-carbon values of the interviewed residents were desirable, but this view may not necessarily lead to low-carbon attitudes and behaviors, and there is a gap between the two. Existing studies confirm this conclusion [51] (see Table 5).

Table 5
Residents' low-carbon values and attitude outcomes

	Very disagree	Disagree	Neutral	Agree	Very agree
VA1	2.56%	1.03%	6.15%	48.72%	41.54%
VA2	1.03%	1.54%	9.74%	50.77%	36.92%
AT1	7.18%	29.74%	30.77%	20.51%	11.79%
AT2	4.1%	14.87%	40%	30.26%	10.77%
AT3	12.31%	46.15%	18.46%	14.87%	8.21%
AT4	5.64%	13.33%	44.62%	28.72%	7.69%

Residents' psychological space-time distance and its influencing factors. We constructed a structural equation model based on the data obtained from the questionnaire. The relevant test indicators of the model were as follows: NFI = 0.81, GFI = 0.87, AGFI = 0.89, TLI = 0.81, and CFI = 0.84. These metrics indicate that the model is acceptable [52]. Residents' psychological time distance toward low-carbon policies was significantly and positively correlated with policy effects and costs, with correlation coefficients of 0.324 and 0.195, respectively. Furthermore, residents' psychological time distance toward low-carbon policies was significantly and positively correlated with their low-carbon values and attitudes, with correlation coefficients of 0.195 and 0.268, respectively.

Among the four influencing factors that were significantly correlated, policy results had the largest correlation coefficient. A positive policy result can increase residents' psychological distance from the policy. Stronger government policies and improved policy effects will reduce carbon emissions and enhance environmental quality [53]. Residents were willing to provide a policy with a longer implementation time. Residents with better low-carbon values and attitudes also perceive low-carbon policies as having greater psychological distance. This allows more time to implement low-carbon policies, which also reflects residents' support for low-carbon policies. It is worth noting that the higher the cost of the policy, the longer the psychological time distance of residents. Owing to the high cost, it is common practice for the government to invest in installment costs, which naturally lengthens the policy time. Policies implemented at present will have both short- and long-term effects [8] (see Figure 3).

We also constructed a structural equation model to explore the relationship between the spatial distance of residents, low-carbon policies, and their influencing factors. We divided the variables into latent and explicit variables, constructed different structural equation models, used the Amos software to construct different fitting models, and finally arrived at a relatively optimal model based on several iterations of screening and correction. The relevant test indicators of the model were as follows:

Figure 1
Psychological time-distance score of interviewed residents toward low-carbon policies

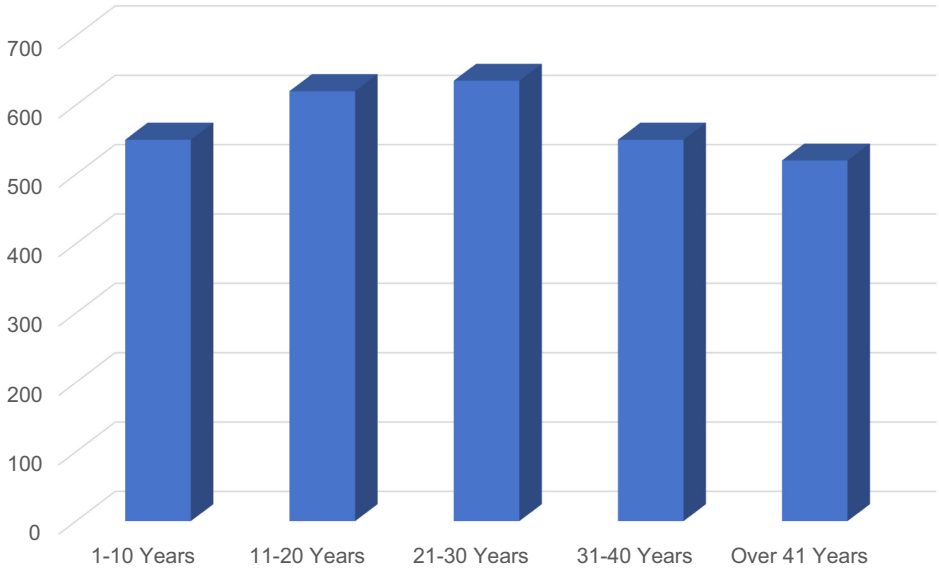
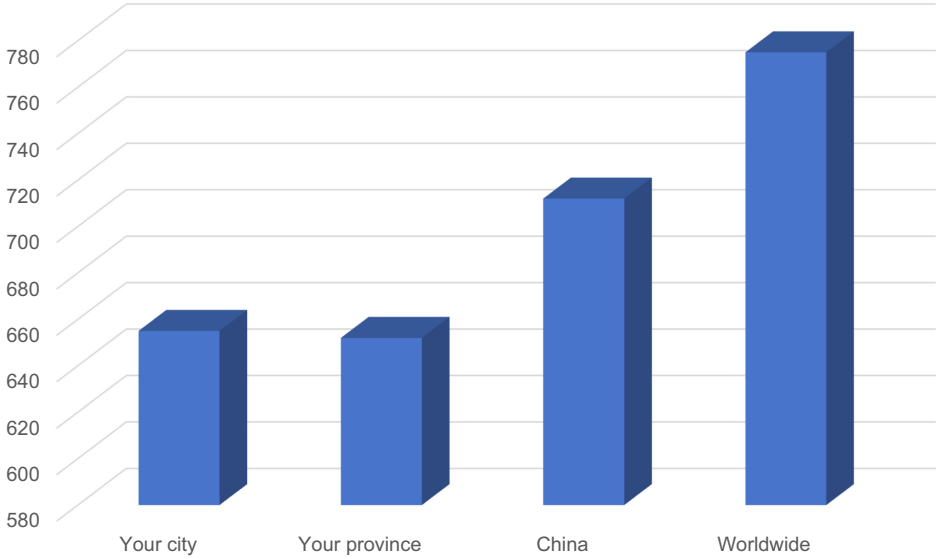
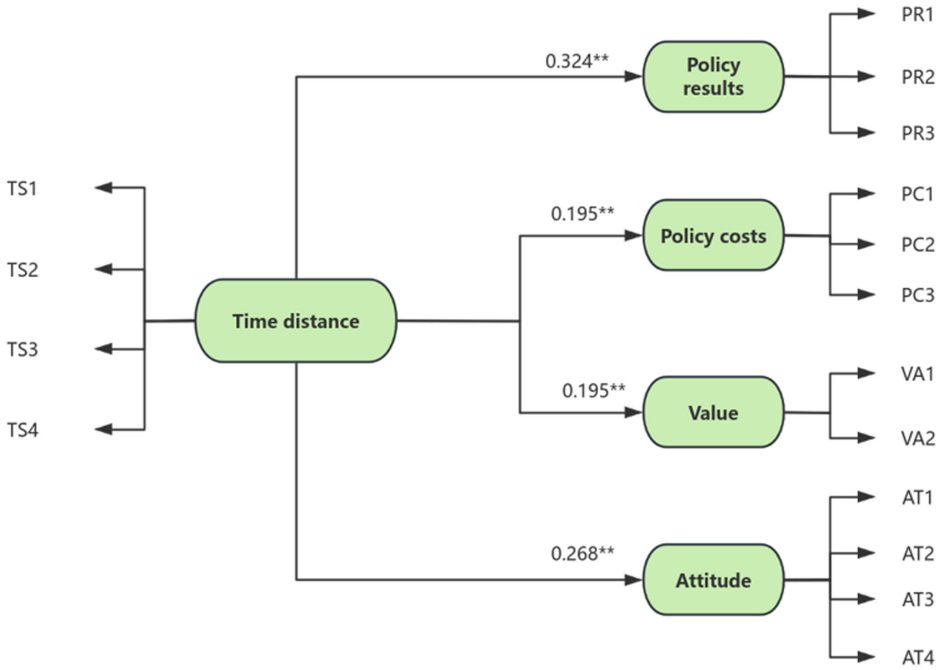


Figure 2
Psychological spatial distance scores of residents who responded to low-carbon policies



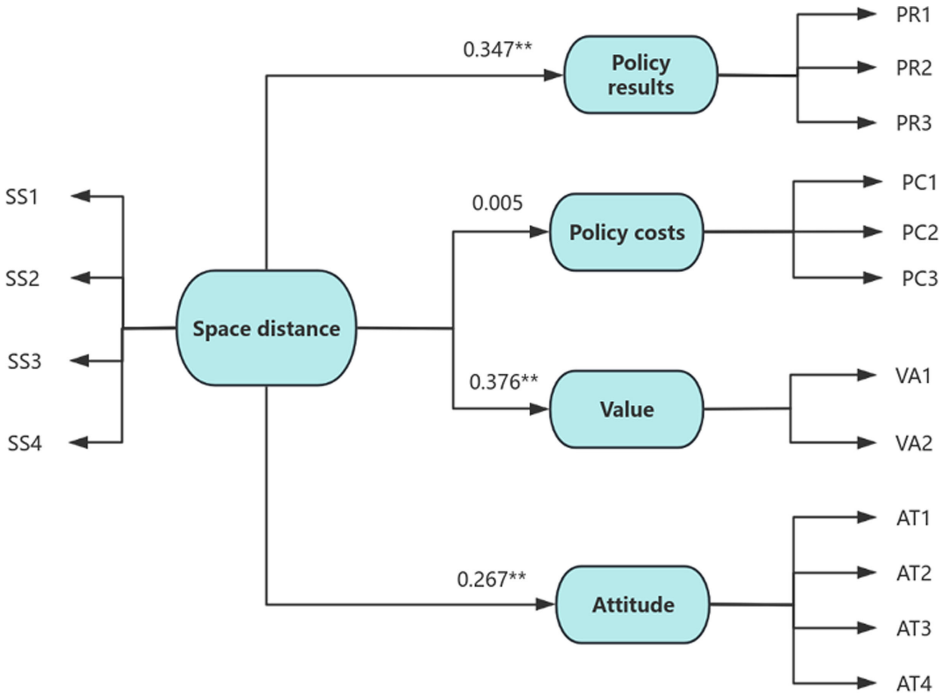
NFI = 0.82, GFI = 0.85, AGFI = 0.83, TLI = 0.84, and CFI = 0.82. The psychological distance of residents toward low-carbon policies was significantly positively correlated with the results of low-carbon policies (0.347). The psychological space distance of residents toward low-carbon policies was also significantly and positively correlated with residents' low-carbon values and attitudes, with correlation coefficients of 0.376 and 0.267, respectively. Residents' low-carbon value correlation coefficients were the largest among the three factors that passed the significance test. Residents with better low-carbon values and attitudes had greater psychological and spatial distances. Residents with better low-carbon values and attitudes were more aware of the scope of low-carbon policies, the relationship between them, and global climate change. Therefore, these residents had a wider psychological space to implement low-carbon policies. It's not limited to their neighborhoods or cities. Meanwhile, the results of low-carbon policies still had a positive impact on residents' psychological space distance. If the effect of the policy is positive, it is natural to hope that it will extend to a wider area (see Figure 4).

Figure 3
The time distance of residents to low-carbon policies and their influencing factors



**. Correlation is significant at the 0.01 level (2-tailed).

Figure 4
The space distance of residents to low-carbon policies and their influencing factors



**. Correction is significant at the 0.01 level (2-tailed).

5. Conclusion

To analyze residents' psychological space-time distance to low-carbon policies and their influencing factors, we designed a questionnaire and surveyed Chengdu, a low-carbon pilot city in China. According to the questionnaire data, we found that the psychological time distance of most residents toward low-carbon policies was between 21–30 years. Consequently, China's goal of achieving carbon neutrality by 2060 seems to be far away for these residents. We also found that most residents' psychological spatial distance toward low-carbon policies was global. Based on a structural equation model, we found that residents' psychological time distance toward low-carbon policies was significantly and positively correlated with policy effects, policy costs, and residents' low-carbon values and attitudes. Residents' psychological spatial distance to low-carbon policies was significantly and positively correlated with the results of low-carbon policies and residents' low-carbon values and attitudes. These conclusions are of great value in guiding residents' psychological space-time distance to low-carbon policies and in improving residents' support. The key contribution is that the findings of this Chengdu-based study can be applied to the entire Sichuan region and even the southwest region, which can strengthen the mass base in policy formulation and implementation on the basis of understanding the psychological spatial and temporal distances guiding the residents, play a positive role in China's low-carbon policies, and contribute to the promotion of global carbon neutrality.

Recommendations

The results of low-carbon policies can significantly affect residents' psychological space-time distance to low-carbon policies. Policymakers can allow policy effects of low-carbon policies to emerge gradually over long periods. This gives residents hope, and policymakers should keep them aware of the effects of this long-term policy, rather than waiting until the final implementation of the policy is completed to see its effects, such as China's carbon neutrality target. This goal can be broken down into different periods, phased in and the effects of the policy published in each period. Policymakers allow residents to feel the effects of the policy in a short period, thereby lengthening their psychological time distance. It also receives the support of residents. Low-carbon values and attitudes can significantly affect residents' psychological space-time distance toward low-carbon policies. Policymakers can guide residents' psychological space-time distance from the perspective of enhancing residents' low-carbon values and attitudes. Possible methods include public service advertisements and publicity, as well as fostering good low-carbon values and attitudes from an early age, starting with school education at all stages. Enhancing communication raises residents' awareness of global warming and climate change, which, in turn, increases their low-carbon awareness. Enhancing communication with residents regarding climate change requires policymakers to emphasize the reality of climate change [8].

This study has some limitations. For example, the influencing factors that may affect the psychological space-time distance of residents need to be increased. Future research should focus on expanding the sample size of interviews and incorporating additional influencing factors for empirical analysis. The study sample focused on those with higher education, and the study will be further expanded to include those with no higher education. Guizhou province is also rich in carbon sinks, so our next step will be to study Guizhou province to enhance the rigor of our conclusions. However, the findings of this study are valuable for the construction of low-carbon cities and realization of carbon neutrality goals in China. It also lays the foundation for how other regions guide residents' policies on psychological space-time distance.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

Data available on request from the corresponding author upon reasonable request.

Author Contribution Statement

Yong Liu: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. **Shaoyi Sun:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, Visualization.

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