International Journal for Housing Science and Its Applications

Publish September 9, 2025. Volume 47, Issue 1 Pages 519-527

https://doi.org/10.70517/ijhsa47144

Contemporary Expression Strategies for New Chinese Style in Modern Villa Spaces

Jin Lu[1,*]

[1] College of Arts and Design, Daqing Normal University, Daqing, Heilongjiang, 163712, China

Corresponding authors: (e-mail: dqsflujin@163.com).

Abstract With the strengthening of cultural confidence in the context of globalization, the new Chinese-style design, as a fusion of traditional Chinese aesthetics and modern design concepts, has gradually become an important trend in high-end residential design. This study explores the integration strategies of the new Chinese-style design in modern villa space design and systematically analyzes its design methods. Based on spatial syntax theory and combined with point cloud technology, Project A was selected for quantitative analysis and case verification of the new Chinese-style villa space. Project A demonstrates superior comprehensibility, with higher global proportions of transition and circulation spaces, higher permeability of living spaces, and greater accessibility of living spaces compared to Western-style projects. Within Project A's internal structure, core areas A4 (integration degree 0.62) and A6 (integration degree 0.69) form a dual-center structure, with core spaces A4, A6, A7, and A5 exhibiting strong spatial aggregation.

Index Terms New Chinese-style, modern villa space, spatial syntax, point cloud technology

I. Introduction

In recent years, the new Chinese-style design has been widely applied in modern villa space design and has achieved notable success [1], [2]. The new Chinese-style design integrates the essence of traditional Chinese design, highlights the aesthetic appeal of traditional design, and inherits the overall requirements of design [3], [4]. Unlike traditional Chinese-style design, the new Chinese-style design not only continues the essence of traditional Chinese-style design but also incorporates modern materials into Chinese elements. Based on the traditional Chinese-style design elements such as shifting views, window lattices, and furniture, it highlights the depth and cultural heritage of modern living environments [5]-[8]. Currently, the new Chinese style has become one of the mainstream trends in villa space design, emphasizing simplicity, naturalness, and elegance [9], [10].

With the growing pursuit of culture and the improvement of living standards, the application of the new Chinese style in villa space design holds numerous future development trends [11], [12]. Emphasizing cultural depth is a key manifestation of the new Chinese style in villa space design [13]. Traditional Chinese culture encompasses rich philosophical ideas and aesthetic concepts. The new Chinese style should better integrate these values into spatial design, presenting traditional cultural elements to allow residents to feel the charm of traditional culture and enhance their sense of cultural identity and belonging [14]-[17]. Personalized expression is another aspect of this style. Incorporating the homeowner's personality traits and lifestyle habits into the design creates a unique and personalized space [18], [19]. This can be achieved through the use of artwork or decorative items to showcase personal interests and hobbies, as well as functional designs to meet the homeowner's needs, thereby making the villa space design more personalized and private [20]-[22]. With the growing awareness of environmental protection, people are increasingly focusing on the use of natural materials and energy conservation and emissions reduction. Emphasizing environmental friendliness and sustainability is an important aspect of the new Chinese-style design in villa space design that cannot be ignored. In villa space design, environmentally friendly materials can be used to reduce material pollution and emissions in the space [23]-[26].

This paper first explains the three core strategies of the new Chinese-style design from the perspective of design methodology, achieving cultural continuity through the combination of materials, decorations, and furniture. By introducing spatial syntax theory, this paper establishes a scientific spatial analysis framework through quantitative model construction and point cloud preprocessing technology. Taking Project A as the research object, this paper achieves precise spatial data modeling through point cloud registration technology. Based on spatial syntax comparison analysis, this paper explores the similarities and differences between the new Chinese-style and Western-style in terms of spatial organization logic. This paper conducts an in-depth analysis of the internal structure of Project A to uncover its spatial layout characteristics.

II. Design Methods for New Chinese Style in Modern Villa Spaces

II. A. Combining tradition and modernity

The New Chinese-style design seamlessly blends traditional and modern elements in interior space design across multiple dimensions. In terms of material selection, the New Chinese-style design combines traditional materials such as rosewood, silk, and lacquerware with modern materials like glass, metal, and stone, creating a harmonious fusion of traditional and contemporary aesthetics within the space. In terms of decorative elements, the design of New Chinese-style spaces can incorporate traditional Chinese cultural decorative elements into the appearance of modern soft and hard furnishings, allowing the modern ambiance of a villa space to subtly reveal the charm of Chinese culture. In terms of furniture selection, choosing New Chinese-style furniture with a modern minimalist design yet retaining a certain cultural ambiance is recommended. Such furniture aligns with the overall style while also offering modern practical functionality. In summary, the New Chinese style in interior space design skillfully preserves traditional Chinese decorative elements while integrating them with modern interior design concepts. This satisfies people's love for traditional Chinese culture and their pursuit of practicality in modern home environments, thereby showcasing the charm of the fusion of modernity and tradition.

II. B. Integration of Nature and Culture

The New Chinese-style design emphasizes the integration of nature and human culture. Natural elements are often incorporated into indoor spaces, with a focus on the selection of natural materials such as wood, stone, and bamboo during the decorative design process. Additionally, ample natural light and green plant decorations are considered to create a warm and comfortable natural ambiance in villa spaces, thereby enhancing residents' spatial experience. Additionally, the New Chinese-style design incorporates appropriate traditional cultural and artistic elements into the space, such as landscape paintings on walls, ceramic ornaments, and modern furniture infused with Chinese cultural elements. These elements not only add decorative value to the space but also reflect respect for and the preservation of traditional Chinese cultural and artistic heritage. Natural elements and humanistic elements complement and blend seamlessly within the space. Their interplay elevates the quality and value of modern villa design, allowing people to not only enjoy the comfort of a natural environment but also appreciate the charm of traditional Chinese cultural art.

II. C. Planning of Space and Layout

Any type of interior space design relies on reasonable spatial layout and planning, and this is especially true for villa space design in the new Chinese style. When applying the new Chinese style to villa space design, the first consideration should be the symmetry and harmony of the overall spatial layout. This approach can subtly highlight the solemn grandeur of traditional Chinese architecture while also creating a harmonious atmosphere within the villa space. Secondly, it is important to consider the rationality of human traffic flow within the space and the overall transparency of the spatial layout. When planning the layout, it is crucial to clearly define the flow relationships between different functional zones, ensuring that the traffic flow is smooth, natural, convenient, and efficient. Ventilation and natural lighting should also be prioritized, with efforts made to maximize the introduction of natural light. Finally, comfort and practicality must be considered. When applying the new Chinese-style design to villa space planning, it is crucial to optimize the utilization of each functional space's area to enhance practicality. Furniture placement should be arranged reasonably, and storage functions for walls, cabinets, and other elements should be fully utilized to maximize the use of available space.

III. Modern villa space design based on spatial syntax

III. A. Spatial quantification

III. A. 1) Analysis of the construction of quantitative models

The interplay between the visible and accessible layers within the villa garden reduces the spatial legibility, yet this numerical deficiency does not result in a poor spatial experience. This is due to the unique spatial hierarchy of classical Chinese gardens, where visible areas are not necessarily accessible—a characteristic spatial ambiance of private gardens. The design techniques later summarized as “seeing the big picture through the small” and “changing views with each step” are all based on this fundamental structural composition. A series of unit spaces are organized and connected through carefully designed spatial relationships, forming an uninterrupted experiential space. The constantly changing unit spaces and shifting perspectives evoke diverse behavioral responses in people.

The primary reason people are drawn to explore garden spaces is the constant changes between spatial interfaces and visual interfaces. Under the garden space sequence, people's emotions are influenced by the spatial environment they are in and the effect of visual penetration within that space. These two aspects correspond to the two research methods of the accessible layer and the visible layer. Changes in visual perception on spatial interfaces can be analyzed through quantitative methods in the accessible layer of the field of view, while the effects of visual penetration can be studied through the visible layer model of the field of view. Depthmap software is one of the primary analytical tools based on spatial syntax principles. To enhance the precision of field-of-view model calculations, the accessible layer and visible layer correspond to spatial integration, field-of-view area, and diameter within the algorithm. If the visible layer and accessible layer are not calculated separately, the definition of "walls" becomes ambiguous. However, gardens often employ visual penetration techniques to convey spatial ambiance, this makes it difficult to accurately represent certain virtual spaces in the software. Additionally, for the field of view method, small paths or bridges over lakes cannot be expressed in the field of view model if they are not studied at different levels. Therefore, to reduce the limitations of spatial syntax algorithm analysis, garden spaces are divided into two layers—the visible layer and the accessible layer—for research and analysis.

III. A. 2) Parameterization choices for quantitative models

Spatial syntax was initially developed to study large-scale architectural spaces, with research subjects characterized by very clear spatial boundaries and distinct geometric properties. In classical Chinese gardens, courtyards hold a prominent position. In the formation of garden spatial sequences, rockery, water features, and plants and trees are also crucial components of garden design. However, the forms and boundary definitions of these elements vary across different elevation levels in their planar projections, leading to the non-uniqueness of spatial boundaries—what is visible may not be accessible. Additionally, the degree of obstruction varies across different elevation levels. To analyze this using spatial syntax, it is necessary to translate these elements into spatial syntax.

Based on field survey data, existing plan views and satellite aerial photographs are used as the base map for drawing, with visible ranges set at 30m and 105m for the visible layers. Within 30m, if there are no obstructions, people can fully perceive the space through vision and hearing, communicate easily with each other, and it is a very clear spatial venue. Beyond this range, it becomes difficult to discern human movements. Between 30m and 105m, communication becomes difficult, specific objects cannot be identified, and a sense of spatial distance is created. In selecting the vertical height for the visual field model, the average height of Chinese adults (1.7m) is used as the standard. Structures exceeding 1.7m are considered visual obstructions and are represented in CAD software, while unobstructed areas are not depicted. In the feasible layer, rocks that affect people's walking routes are used as spatial boundaries. Additionally, since the Depthmap software's algorithm primarily analyzes planar angles, it cannot accurately calculate vertical elevation differences. To ensure the rigor of the final results, paths on artificial hills are avoided whenever possible.

III. B. Point cloud preprocessing

III. B. 1) Point Cloud Sampling

To ensure the efficiency and effectiveness of point cloud processing technology and reduce the impact of differences in point cloud quantity and density, this study first implemented sampling processing of point cloud data. The main point cloud sampling methods used include grid sampling, uniform sampling, and geometric sampling. These methods each have their own characteristics in terms of maintaining the key features of point clouds, and they have a significant impact on the performance of the processing workflow and the accuracy of the final results.

This paper primarily introduces farthest point sampling within uniform sampling, with the specific steps outlined below:

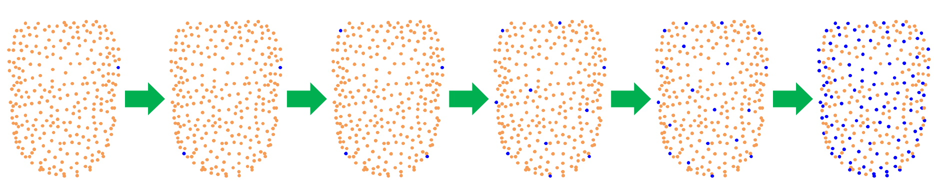
(1) Randomly select a point as the starting point and add it to the sampling point set S.

(2) For the remaining points, calculate the shortest distance from each point to all points in the set S. (Typically, the Euclidean distance is used as the distance metric.)

(3) Select the point with the greatest distance as the next sampling point and add it to the sampling point set.

(4) Repeat steps (2) and (3) until the sampling point set reaches the desired number or until all points have been selected.

In this way, the final sampling point set can be guaranteed to be uniformly distributed throughout the point cloud and cover the main features of the entire point cloud. The algorithm implementation process is shown in Figure 1, where the number of sampling points in the set S from left to right are 1, 2, 4, 10, 20, and 100. The time complexity of the farthest point sampling algorithm is $o\left(S^2\right)$.



(a)S=1 (b)S=2 (c)S=4 (d)S=1 (e)S=20 (f)S=10

Figure 1: Furthest point sampling algorithm

When the number of sampling points for farthest point sampling is fixed, the sampling of the point cloud surface is uniform and irregular. Given the same number of centroids, farthest point sampling provides better coverage of the entire point set than random sampling. Big grid sampling is more efficient and requires fewer points to simulate the original point cloud.

III. B. 2) Point Cloud Denoising

This study employs a statistical outlier detection (SOR) method to identify and remove outliers. This technique is based on the assumption that point cloud data follows a specific statistical distribution, and points deviating from this distribution are considered outliers. Indoor point cloud data obtained from 3D laser scanning often exhibits inconsistent density and sparse outliers, which collectively reduce the overall quality of the data. High-density regions typically contain more information, while outliers are considered low-information noise. This noise not only reduces the overall quality of the point cloud but may also hinder the precise identification of local features, thereby affecting the effectiveness of subsequent processing workflows. Therefore, the goal of point cloud denoising is to remove these low-information points to improve data quality and usability.

First, set the number of k nearest neighbor points to be searched for. Then, use the average nearest neighbor distance to remove points that deviate too much from the average value, thereby achieving the purpose of noise reduction. For each point p_i, search for their k nearest neighbor points as follows:

$$P_i = \{p_1, p_2, \dots p_k\}, i = 1, 2, \dots, N \tag{1}$$

Then calculate the average distance between that point and its nearest neighbors as follows:

$$d_k = \frac{1}{k}\sum_{j=1}^{k}\left\| p_i - p_j \right\|, i = 1, 2, \dots, k \tag{2}$$

Then the average distance d_i satisfies a normal distribution:

$$d_i \sim N\left(\mu, \sigma^2\right) \tag{3}$$

Therefore, set the threshold ξ to eliminate outliers:

$$\mu - \xi\sigma \le d_i \le \mu + \xi\sigma \tag{4}$$

Points that meet the above conditions are retained, while points outside the threshold are removed as noise outliers. The threshold ξ significantly affects the denoising performance of SOR filtering. When the threshold is small, the denoising effect is better, but there is a risk of removing some necessary feature point clouds. On the other hand, when the threshold is too large, the denoising effect is reduced. Therefore, it is necessary to select an appropriate threshold based on the actual situation to ensure that the experimental results meet expectations.

III. B. 3) Point Cloud Coordinate System Redirection

During the acquisition of indoor point cloud data, cumulative errors in the scanning equipment result in significant deviations between the original point cloud coordinate system and the actual gravitational coordinate system. To address this issue, this study employs a coordinate system reorientation strategy aimed at aligning the Z axis of the point cloud data with the vertical direction of the gravitational coordinate system. By applying principal component analysis (PCA), this study predefines a new point cloud coordinate system. Next, by comparing this new coordinate system with the actual gravitational coordinate system, the rotation matrix between the two is calculated, thereby correcting the orientation of the point cloud. This process not only enhances the accuracy and reliability of the data but also lays a solid foundation for further processing and application of the point cloud data.

When processing point cloud data using principal component analysis (PCA), the data is first constructed as a $m \times n$-dimensional matrix P, where m represents the total number of points in the point cloud, and represents the spatial dimension of each point. The subsequent analysis steps include:

(1) Calculating the covariance matrix of the point cloud data matrix P;

(2) Solving for the eigenvalues λ_i of the covariance matrix and their corresponding eigenvectors vi. These eigenvectors $\left(v_1, v_2, v_3\right)$ are sorted according to the magnitude of their corresponding eigenvalues $\left(\lambda_1 < \lambda_2 < \lambda_3\right)$, representing the three primary distribution directions of the point cloud data;

(3) Based on the eigenvectors identified in step (2), construct the rotation matrix R.

$$\begin{cases} X = v_1 \times v_2 \\ Y = X \times v_2 \\ Z = X \times Y \end{cases} \tag{5}$$

Rotation matrix:

$$R = [X, Y, Z]^T \tag{6}$$

(4) Complete point cloud coordinate system reorientation based on the rotation matrix R and matrix rotation formula.

$$P' = R \cdot P \tag{7}$$

In formula (7), P' is the point cloud matrix after coordinate system reorientation.

By reorienting the coordinate system of the indoor point cloud data, the vertical point cloud is made parallel to the direction of gravity, laying the foundation for subsequent indoor point cloud spatial segmentation and semantic labeling.

IV. Analysis of a New Chinese-Style Villa Space Design Based on Spatial Syntax

IV. A. Point Cloud Registration

The research project is a new Chinese-style villa space in City A, designated as Project A. Project A data was scanned from 10 sites, utilizing 8 target balls. Data stitching was performed using the proprietary software of a certain company's self-developed 3D scanning device, which supports various stitching methods such as automatic stitching, target ball stitching, target paper stitching, and feature point stitching. Project A is a relatively simple case with a small number of stations. For this scenario, this paper employs the software's built-in ICP algorithm to perform precise stitching of Project A's point cloud data and analyze the stitching results. Using the Rodrigo matrix algorithm, target annotation is applied to perform target-based stitching of Project A's point cloud data, achieving precise registration of the point cloud data. The stitching accuracy is directly verified using the target spheres.

Without a specified initial position, the automatic stitching of point cloud data yields unsatisfactory results, with noticeable errors, and the scanned data from each station exhibits significant misalignment after stitching. After selecting a better initial position using the software's built-in ICP algorithm, the stitching results improved significantly, with a notable increase in stitching accuracy. Therefore, the selection of the initial position is crucial for point cloud registration. It is recommended to select the initial position based on the on-site scanning conditions or through the ICP algorithm. Combining the ICP algorithm with the initial registration can achieve precise registration of point cloud data and yield good registration results.

As shown by the registration results, the point cloud data exhibits good alignment and high precision after target-based registration, with satisfactory registration quality. Precision verification is achieved using target spheres. After registration, the target spheres are segmented to obtain their point cloud models. Through model encapsulation and slicing processing, the actual diameter of the target spheres is calculated. Finally, the registration accuracy is indirectly indicated by the diameter deviation values of the eight target spheres. The registration accuracy results are shown in Table 1. It can be seen that the maximum diameter deviation of the target ball is 1.33 mm, and the minimum deviation is 0.16 mm. The registration accuracy is very high, far below the 5 cm point measurement accuracy of traditional total stations.

Table 1: Registration Accuracy Results (mm)

Target ball number	Original target ball diameter	The diameter of the target ball after registration	Diameter difference
X1	500	500.19	0.19
X2	500	500.74	0.74
X3	500	501.08	1.08
X4	500	498.92	-1.08
X5	500	499.84	-0.16
X6	500	498.95	-1.05
X7	500	501.33	1.33
X8	500	500.94	0.94

IV. B. Spatial syntax analysis

IV. B. 1) Understandability

The comprehensibility index measures the correlation between overall integration and local integration values, indicating the degree to which people can understand a space. An example of the comprehensibility of a standard villa space is shown in Figure 2. The closer the correlation coefficient R^2 is to 1.0, the higher the level of comprehensibility of the space. This means that based on the local spatial layout, people can more easily understand the entire space.

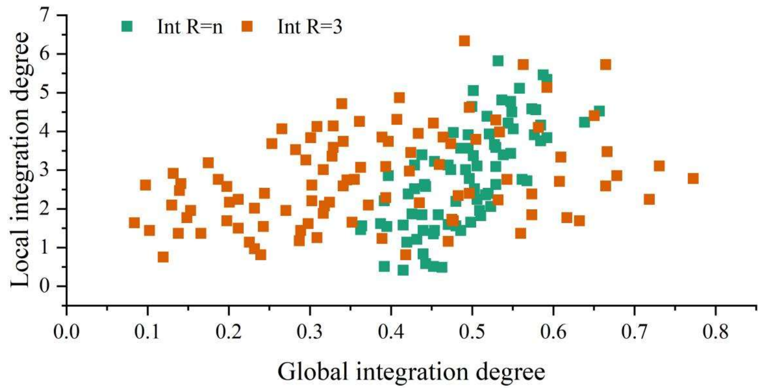


Figure 2: An example of intelligibility of a standard villa space

Two outstanding Western-style villa construction projects (designated as B and C) and the outstanding new Chinese-style villa construction project D were selected for comparison with project A. The results of the comprehensibility analysis for the four projects are shown in Figure 3. After calculation, the R^2 value for Project A is 0.598, the R^2 value for Project B is 0.423, the R^2 value for Project C is 0.436, and the R^2 value for Project D is 0.548. It is evident that Project A demonstrates superior comprehensibility, and the insights gained from its floor plan layout can be summarized to provide a basis for future design of similar spaces.

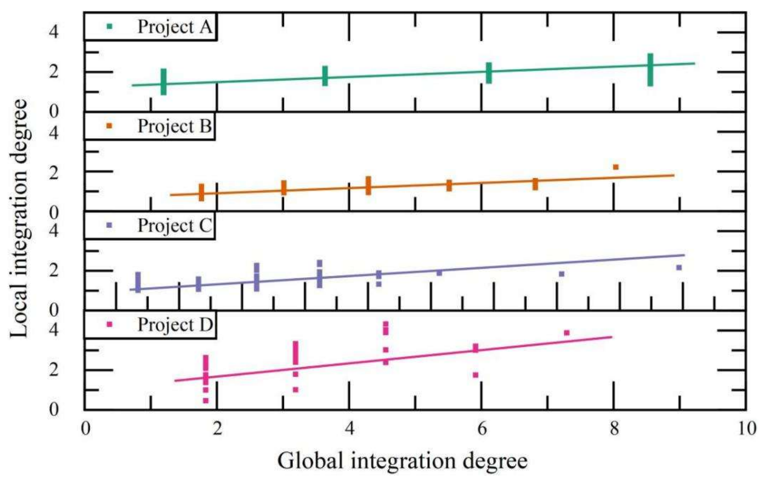


Figure 3: Results of intelligibility analysis

IV. B. 2) Connectivity

Transition and circulation spaces serve the function of connecting and separating spatial domains, and are an important indicator for measuring the aggregation and dispersion of functional spaces. The larger the proportion of transition and circulation spaces, the greater the likelihood of indirect connections between activity spaces, and the stronger the spatial independence. The total number of connections and the maximum connectivity indicate the penetrability of transition and circulation elements into the overall spatial domain. The syntactic values of transition and circulation spaces for different projects are shown in Table 2. Project A's global proportion of transitional and circulation spaces is similar to that of Project D, both around 0.5, higher than Projects B and C, indicating that Projects A and D have a greater likelihood of indirect connections between activity spaces and relatively independent spatial configurations, while Projects B and C exhibit relatively weaker spatial independence. The maximum connectivity spaces for the four projects are, respectively, the semi-outdoor corridor space, the indoor corridor space, the indoor corridor space, and the outdoor courtyard space, indicating that Projects A and D place greater emphasis on the permeability of outdoor spaces compared to Projects B and C. Project A has the highest transition and circulation space values, indicating that its transition and circulation spaces exhibit strong permeability into the global domain of residential spaces.

Table 2: Transition and transportation space syntactic values of different projects

	The overall proportion of transitional and transportation spaces	Transition and transportation space connection value	Maximum connectivity of transition and transportation spaces	Maximum connectivity space
Project A	0.52	4.7	11	Veranda
Project B	0.31	2.9	8	Corridor
Project C	0.28	3.4	5	Corridor
Project D	0.49	2.6	9	Courtyard

IV. B. 3) Integration and Topological Depth

Social spaces are the outward-facing areas of a residence, while living spaces are areas that require privacy. The spatial relationship between these two types of spaces is a key characteristic of a residence's privacy.

The integration values and topological depth values for different projects are shown in Table 3. The accessibility of living spaces in Projects A and D is significantly stronger than that of Projects B and C, making them easier to visit, which reflects the weaker privacy requirements of Chinese-style living spaces compared to Western-style living spaces. The average depth difference between the residential and social zones in Project A is only 0.68, far lower than the 1.33 in Project B and 1.42 in Project C, indicating a flatter spatial hierarchy. This design retains the traditional Chinese architectural sequence of “progressive courtyards” while optimizing circulation efficiency through modern elements like a central circular hall, achieving a harmonious integration of traditional spatial aesthetics and modern functional requirements.

Table 3: Integration Degree Values and Topological Depth Values of Different Projects

	Housing integration degree	Social integration degree	Topological depth value of the residential area	Social network topology depth value	Topological depth value between internal and external domains
Project A	1.65	1.97	2.86	2.18	2.94
Project B	0.81	0.89	5.44	4.11	5.03
Project C	0.75	0.94	5.39	3.97	4.96
Project D	1.45	1.83	3.37	2.05	3.21

IV. C. Internal Structure Analysis

The spatial structure of Project A was subjected to axis-based processing, and the spatial syntax characteristic values of each group within Project A are shown in Table 4. Based on numerical statistics, the core areas A4 (integration degree 0.62) and A6 (integration degree 0.69) form a dual-center structure, with average control values (CV) of 1.07 and 0.71, respectively, indicating that these two clusters play a dominant role in the global spatial network. The integration degree values exhibit a trend of decreasing in concentric layers, with higher values in the middle and lower values on the sides.

Table 4: Spatial syntactic feature values of each cluster

	Number of nodes	Average CN value	Average Rn value	Average MD value	Average CV value
A1	15	3.1	0.51	14.22	1.01
A2	9	2.6	0.48	14.15	0.93
A3	7	2.4	0.49	13.26	0.96
A4	26	3.5	0.62	10.28	1.07
A5	8	2.7	0.53	14.56	0.89
A6	3	1.2	0.69	9.37	0.71
A7	9	2.8	0.52	12.44	0.98
A8	17	2.4	0.48	11.93	1.03
A9	9	2.7	0.51	12.35	0.96

Saturation is used to discuss the manifestation of spatial sequences in terms of steps, and spatial hierarchy is used to organize social structures. The saturation of a node is directly related to its depth. In spatial syntax, the depth value of a node is determined by calculating the topological step count, which reflects the node's position and connectivity within the spatial network. As the topological depth increases, the node's saturation also increases accordingly. When the node's depth value reaches its maximum possible value, the corresponding step count represents the node's saturation. This concept aids in analyzing and understanding the importance and centrality of nodes within a spatial network.

The saturation of all nodes in the spatial structure of Project A was statistically analyzed, and the results of the spatial syntax saturation values for each cluster are shown in Table 5. Project A has a rich spatial hierarchy and a dispersed location, with the core spaces being A4, A6, A7, and A5. The four clusters are directly connected, and the core spaces have strong aggregation.

Table 5: Statistical Results of Spatial Syntax Saturation Levels of Each Group

	Saturation/Global Depth	Min	Max
A1	4018.68	3475	4322
A2	3786.34	3473	3908
A3	3417.48	3215	3974
A4	3104.37	2874	3652
A5	3205.66	2908	3578
A6	2893.41	2911	2891
A7	3309.38	3087	3675
A8	3294.26	3612	3588
A9	3918.43	3525	4108

V. Conclusion

This study systematically argues the design strategies and application effectiveness of the new Chinese style in modern villa spaces through a combination of theory and practice.

The R^2 value for Project A is 0.598, the R^2 value for Project B is 0.423, the R^2 value for Project C is 0.436, and the R^2 value for Project D is 0.548, indicating that Project A has superior comprehensibility. The overall proportion of transition and circulation spaces in Project A is similar to that of Project D, both around 0.5, higher than Projects B and C. Projects A and D place greater emphasis on the permeability of outdoor spaces compared to Projects B and C, with Project A exhibiting the strongest permeability of transition and circulation spaces into the overall residential space. The accessibility of residential spaces in Projects A and D is significantly stronger than that of Projects B and C. The average depth difference between the residential and social zones in Project A is only 0.68, far lower than Project B's 1.33 and Project C's 1.42, indicating a flatter spatial hierarchy.

Within Project A's internal structure, the core areas A4 (integration index 0.62) and A6 (integration index 0.69) form a dual-center structure, with average coefficient of variation (CV) values of 1.07 and 0.71, respectively. The integration values show a trend of decreasing in concentric layers, with higher values in the middle and lower values on the sides. Project A has a rich spatial hierarchy with dispersed locations, with core spaces being A4, A6, A7, and A5. These four clusters are directly connected, exhibiting strong spatial aggregation.

References

[1] Gang, L. O. U. (2018). The application of bamboo elements in" New Chinese-Style" landscape design. Journal of Landscape Research, 10(4), 72-77.

[2] Chang, Q. (2019). Architectural models and their contexts in China's 20th-century architectural heritage: An overview. Built Heritage, 3(4), 1-13.

[3] Qiu, X. (2019). Development in Chinese Residential Building Project Construction. In China 40 Years Infrastructure Construction (pp. 13-35). Singapore: Springer Singapore.

[4] Nia, H. A. (2017). Courtyard housing in China: Chinese quest for harmony. Journal of Contemporary Urban Affairs.

[5] Xiao'ou, C. (2024). Design in the "New Era". In Chinese Modern Design Thinking: Life, Enlightenment, Change (pp. 121-163). Singapore: Springer Nature Singapore.

[6] Ivashko, Y., Chang, P., Zueva, P., Ding, Y., & Kuzmenko, T. (2021). Continuity of traditions and innovation in modern landscape design in China. Landscape architecture and Art, 18(18), 94-103.

[7] Wang, Y., & Chen, Y. (2014). Architectural Research with Initial Exploration on New Chinese-style Landscape Design Method. Advanced Materials Research, 1046, 144-147.

[8] Wu, Y., Wu, Y., & Mao, Y. (2022, September). Check for updates Research on the Transformation and Development of Modern Western-Style Villas in Suzhou Under the Concept of Sustainable Development. In Proceedings of the 2022 International Conference on Green Building, Civil Engineering and Smart City (Vol. 211, p. 190). Springer Nature.

[9] Chao, L., & Suhaily, S. S. (2024). Application of Traditional Cultural Elements in the Design of New Chinese-Style Furniture. Pakistan Journal of Life & Social Sciences, 22(2).

[10] You, C., & Mai, X. (2019). Inspiration of taoist thought and culture on the "new Chinese style" landscape design. Art and Design Review, 7(2), 68-77.

[11] Lei, Z. H. A. N. G., Shan, Z. H. O. U., & Peipei, B. A. O. (2014). Merging Traditional Dwelling Form into Modern Neighborhood--A Holiday Villa District's Planning and Design in Shanghai. Journal of Landscape Research, 6.

[12] Lai, D. (2014). Idealizing a Chinese style: Rethinking early writings on Chinese architecture and the design of the national central Museum in Nanjing. Journal of the Society of Architectural Historians, 73(1), 61-90.

[13] Ingarden, K. (2018). Contemporary Chinese architecture of the second wave. Teka Komisji Urbanistyki i Architektury Oddziału Polskiej Akademii Nauk w Krakowie, 161-176.

[14] Liu, X., Wang, Z., Liu, J., & Yang, Z. (2015). Concept Design and Development Model of Underground Villas. Journal of Engineering Science & Technology Review, 8(3).

[15] Wu, Y. (2024). Exploration of the integration and application of the modern new Chinese style interior design. International Journal for Housing Science and Its Applications, 45, 28-36.
[16] Yin, Z., & Ruishuang, X. (2021, May). Application of new Chinese style in interior design--take the cultural and creative museum of the palace museum as an example. In IOP Conference Series: Earth and Environmental Science (Vol. 768, No. 1, p. 012144). IOP Publishing.
[17] Wang, J. (2020). The design method of leading space of new Chinese style residential area. Journal of Landscape Research, 12(2), 19-22.
[18] Du, Z., Guo, W., Li, W., & Gao, X. (2022). A study on the optimization of wind environment of existing villa buildings in Lingnan area: a case study of Jiangmen's "Yunshan Poetic" moon island houses. Buildings, 12(9), 1304.
[19] Wang, Y. T., Liang, C., Huai, N., Chen, J., & Zhang, C. J. (2023, September). A survey of personalized interior design. In Computer graphics forum (Vol. 42, No. 6, p. e14844).
[20] Dananjaya, A. G. (2025). Integrating Modern Sundanese Architecture in Mountain Villa Design and Planning for Tourism. Advances in Civil Engineering and Sustainable Architecture, 7(1), 18-27.
[21] Kolarevic, B. (2018). Metadesigning customizable houses. In Mass customization and design democratization (pp. 117-128). Routledge.
[22] Griz, C., Amorim, L., Mendes, L., Holanda, M. A., & Carvalho, T. (2017). A Customization Grammar: Describing the customization process of apartment design. International Journal of Architectural Computing, 15(3), 203-214.
[23] Paradita, D. S., Rifai, D. M., Rafia, I., Seftianingsih, D. K., & Ticoalu, E. P. T. (2024, December). Designing an Interior Residential House with an Ecological Concept Approach (Friendly Environment). In ICEETE Conference Series (Vol. 2, No. 1, pp. 380-389).
[24] Vân, N. T. B. (2018). Bamboo-the eco-friendly material–one of the material solutions of the sustainable interior design in Viet Nam. In MATEC Web of Conferences (Vol. 193, p. 04014). EDP Sciences.
[25] Ali, Y., & Anjum, F. (2024). Decision framework for eco-friendly hospitality: a sustainable future for hotel industry in high-altitude regions. Journal of Quality Assurance in Hospitality & Tourism, 1-38.
[26] Besheer, A. H., & El-Hamidi, W. (2012). Design procedures for an average Saudi villa using integrated green building techniques. WIT Trans. Ecol. Environ., 165, 39-52.