

Semiotic Translation and AHP-Based Quantitative Evaluation of Architectural Culture: A Case Study of Library Buildings in Guangzhou

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Abstract:

Library buildings serve as both symbolic representations of local culture and spatial manifestations of epistemic power. In response to the issues of cultural semantic ambiguity and subjective value assessment that have emerged in the evolution of library architecture, this study proposes a translational framework that integrates semiotic decoding with the Analytic Hierarchy Process (AHP). Grounded in Peirce's semiotic triad, we propose a three-dimensional framework: morphological syntax, functional semantics, and cultural pragmatics, for extracting and semantically annotating culturally significant signs. Three historic library buildings in Guangzhou—Wanmu Caotang (Qing dynasty), Canton Sun Yat Sen Memorial Library (modern period), and Guangzhou Library (contemporary era)—are examined as case-study alternatives. Empirical findings reveal a clear diachronic trajectory in the cultural pragmatics of library space. The Qing dynasty case was predominantly shaped by an elitist epistemology, manifested through the signifier of “concealing knowledge in a renowned mountain,” privileging preservation over circulation. The modern period witnessed a revolutionary turn toward the nationalist signifier of “all under heaven is for the common good,” reconfiguring the library as a didactic instrument of state-building. The contemporary case has evolved into a de-hierarchized public sphere, where morphological syntax dissolves monumental axiality to accommodate the pragmatics of everyday urban life. By bridging interpretive semiotic analysis with quantitative multi-criteria decision-making, this approach offers an operational methodological reference for assessing cultural continuity in public architecture within historic cities.

Keywords:

Semiotics, Analytic Hierarchy Process (AHP), Library Architecture, Cultural Heritage, Architectural Evolution, Epistemic Power

1. Introduction

The epistemological assessment of architectural heritage faces a persistent methodological gap: qualitative interpretation is rich, yet quantitative verification remains notably absent. While semiotics provides a robust framework for decoding

meaning in architectural form, existing research has largely confined itself to descriptive accounts, failing to translate cultural semantics into measurable, comparable metrics. This limitation impedes any precise correlation between long-term transformational patterns and the relative weight of synchronic analytical dimensions in architecture.

Guangzhou has been a pre-eminent cultural centre in southern China since the Qing dynasty. Its library buildings bear material witness to this legacy: their fabric encodes shifting values, aesthetic preferences, and technological capacities across different eras. As such, these structures are not merely historical artefacts but critical registers of the city's educational evolution and urban metamorphosis.

This study integrates Peirce's semiotic triad and Morris's tripartite model with an Analytic Hierarchy Process (AHP) to compare three typologically distinct library buildings from successive historical periods in Guangzhou. The investigation addresses three research questions: (1) How does the semiotic-cultural significance of these buildings shift across major socio-political and technological transitions? (2) What quantitative relationships obtain among the dimensions of heritage transmission, aesthetic articulation, and functional innovation across these cases? (3) How might this analytical framework contribute to a more critically informed understanding of contemporary library design?

2. Related Research

Recent applications of semiotic theory and the Analytic Hierarchy Process (AHP) in architectural evolution research reveal two parallel yet intersecting shifts: a progressive move beyond qualitative interpretation towards quantitative evaluation, and a concomitant turn from methodologically insular towards analytically integrated approaches.

Within the semiotic domain, Morris's tripartite framework—comprising syntactics, semantics, and pragmatics—has long provided a mature theoretical apparatus for decoding cultural meanings inscribed in architectural form. Liu Qingyue (2020) drew upon this model to examine the transmission of regional character and design strategies in vernacular hostelrys of western Sichuan [1]. Wang Yisheng and Lan Fang (2023) operationalised the same triadic taxonomy—across syntactics, semantics, and pragmatics—to derive design principles for Han dynasty-inspired cultural products [2]. Similarly, the design study of the Nanning Museum employed Morris's triad to deconstruct the translational logic of regional cultural symbols [3]. Collectively, these studies attest to the enduring utility of Morris's framework for qualitative interpretation.

Concurrently, the Analytic Hierarchy Process (AHP) has gained substantial traction as a multi-criteria decision-making tool in architectural evaluation. Zu Qingzhi and Gao Suqin (2025) constructed an AHP-based evaluation system for intelligent building environmental systems [4]. Bahrami Samani et al. (2021) applied AHP to assess the role of archetypes in fostering a sense of place within Iranian mosques, demonstrating its capacity for quantifiable comparison of architectural semantic dimensions [5].

Despite the respective maturity of these two methodological traditions, their integration remains surprisingly nascent. Feng et al. (2026), taking Huizhou-style architecture as a case study, combined semiotic analysis with AHP-weighted

quantification to construct an AI-assisted design framework for traceable cultural heritage [6]. This represents a frontier attempt at what might be termed a 'translational semiotics'—the systematic conversion of qualitative cultural meanings into quantifiable design parameters.

3. Theoretical Framework and Research Methodology

This study proposes a hybrid semiotic-AHP framework to examine the evolutionary characteristics and driving forces of Guangzhou's library architecture: from the classical shuyuan typology of the Qing dynasty to the digitally augmented libraries of the present day. The methodology proceeds through three phases: first, data collection and preprocessing; second, semiotic decoding integrated with AHP-based quantitative weighting; and third, interpretive analysis of the resultant weight matrices.

3.1. Data Collection and Preprocessing

Guangzhou's library architecture spans three distinct historical periods, each leaving a substantial built legacy. From the Qing dynasty (1644–1911), 456 classical academies—shuyuan in their various institutional forms—survive alongside allied scholarly institutions[7]; the Republican period (1912–1949) contributes 57 purpose-built library buildings [8]; and the contemporary era (1950–present) has produced 379 library structures of diverse typologies[9]. This tripartite corpus, totalling nearly 900 buildings, charts the arc of Guangzhou's modern cultural and educational transformation. More significantly for the present study, its diachronic depth and typological range make it a productive testing ground for a methodology that holds semiotic interpretation and quantitative evaluation in creative tension.

We assembled pictorial, textual, and measured-drawing documentation for twenty-three library buildings, from which three historically representative cases were selected: the Wanmu Caotang (The Myriad Trees Study Hall, 1891, the Canton Sun Yat Sen Memorial Library (now the Wende Road Branch of the Sun Yat-sen Library of Guangdong Province, 1933), and the Guangzhou Library in Zhujiang New Town (2012). The archival materials for these three buildings were then systematically processed. Image data were calibrated for scale and perspective, producing image libraries of elevations, floor plans, and detail components. Textual historical records were digitised, segmented, and annotated, then coded and categorised by function, typology, and historical significance. Measured drawings were vectorised, standardised to a unified scale and coordinate system, and compiled into a three-dimensional spatial reference model. Through these operations, a structured multi-source database was established, providing a consolidated foundation for subsequent semiotic decoding and AHP weighting.

3.2. Semiotic Decoding

This study adopts Morris's tripartite framework—syntactics, semantics, and pragmatics [10]—as the theoretical lens for decoding architectural meaning. Within the architectural domain, these three dimensions are mapped onto the analytical categories of this study as follows. Syntactics corresponds to formal-aesthetic expression, encompassing spatial organisation, proportional and scalar relationships, and axial configurations. Semantics corresponds to heritage-transmission value, namely the societal values carried by historical imagery, symbolic motifs, and stylistic idioms. Pragmatics corresponds to functional innovation, addressing use, behavioural affordance, and social impact (Figure 1).

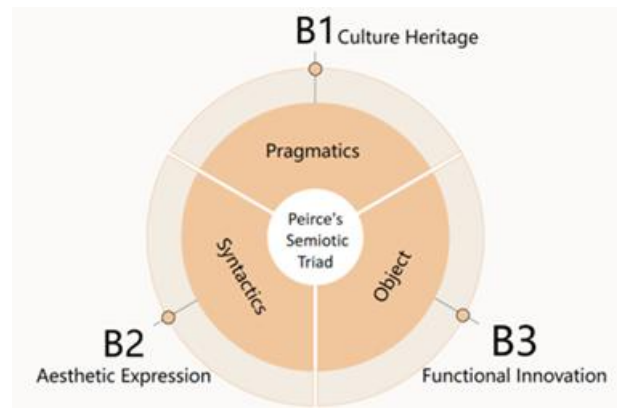


Figure 1. *Correspondence between Semiotics and Architectural Cultural Dimensions.*

3.3. Construction of the Cultural Value Evaluation Framework for Library Architecture

The AHP hierarchy developed for this study comprises three tiers: a goal layer (A), a criterion layer (B), and an indicator layer (C). The overarching goal (A) is defined as the Cultural Value of Library Architecture. The criterion layer (B) consists of three primary indicators: Cultural Heritage Transmission (B1), Aesthetic Expression (B2), and Functional Innovation (B3), which correspond directly to the three architectural dimensions operationalised from Morris's semiotic framework in Section 3.2 (syntactics, semantics, and pragmatics, respectively).

To ensure that these criteria are not only theoretically coherent but also professionally recognisable, we cross-referenced our tripartite structure against the judging criteria of the Architizer A+Awards, a widely recognised professional benchmark in architectural design evaluation[11]. The Architizer framework employs three parallel categories: Form, Function, and Impact, which served as a heuristic for refining our indicator definitions and testing their practical intelligibility against an established professional vocabulary.

The indicator layer (C) elaborates each of the three primary criteria into three sub-criteria, yielding a total of nine evaluation items. These are summarised in Table 1, which maps the semiotic registers (syntactics, semantics, pragmatics), the AHP criteria (B1–B3), and the Architizer reference categories (Form, Function, Impact) for direct comparison. The full set of sub-criteria, together with their operational definitions and scoring rubrics, is detailed in Table 1.

Table 1. *Evaluation Table of the Cultural Value of Library Architecture.*

Goal	Criteria		Dimensions	Alternatives	
A Cultural Value of Library Architecture	B1	Cultural Heritage	Impact	C1	Social Impact
				C2	Innovation in Material/Technology
				C3	Long-term Impact
	B2	Aesthetic Expression	Form	C4	Innovation
				C5	Response to Site
				C6	Aesthetics /Visual Language
	B3	Functiona Innovation	Function	C7	Performance
				C8	Spatial Organization
				C9	Sustainability

3.4. AHP Weight Assignment

3.4.1. Criterion-Layer Weight Analysis

The weights of the three criterion-layer indicators: Cultural Heritage Transmission (B1), Aesthetic Expression (B2), and Functional Innovation (B3), were determined through the Analytic Hierarchy Process (AHP). Six experts participated in the pairwise comparison exercise: three from the field of architecture and three from library science. Each expert independently rated the relative importance of B1, B2, and B3 using Saaty's 1–9 scale. The individual comparison matrices were then aggregated using the geometric mean method to produce a collective judgment matrix $P(A-B)$ for the cultural value of library architecture (Table 2).

The judgment matrix is presented in Table 2. Using the row-sum normalisation method (also known as the sum-product method), the maximum eigenvalue was computed as $\lambda_{\max} = 3.049$, and the resulting priority weight vector was $W = (0.502, 0.208, 0.290)^T$. The consistency of the pairwise comparisons was then assessed. The consistency index (CI) was calculated as 0.025. With the random index (RI) for $n = 3$ set at 0.52, the consistency ratio (CR) was found to be 0.047, which is below the accepted threshold of 0.10. These results confirm that the judgment matrix meets the consistency requirement and that the derived weights are reliable.

Table 2. Judgment Matrix $P(A-B)$ and Criterion Weights.

Goal Level A	Criterion Level B	B1 Cultural Heritage	B2 Aesthetic Expression	B3 Functional Innovation	Weight W	Consistency Check
Cultural Value of Library Architecture	B1 Cultural Heritage	1.000	2.414	1.731	0.502	$\lambda_{\max} = 3.049$
	B2 Aesthetic Expression	0.414	1.000	0.717	0.208	CI = 0.025
	B3 Functional Innovation	0.578	1.394	1.000	0.290	RI = 0.52

3.4.2. Indicator-Level Weight Analysis Using the Entropy Weight Method

While Section 3.4.1 determined the criterion-layer weights through AHP-based subjective judgment, this section proceeds to assign objective weights to the nine sub-criteria (C1–C9) at the indicator layer. To complement the subjective AHP weights with data-driven objective weights—and to mitigate any potential anchoring effects in expert judgment—the Entropy Weight Method (EWM) is employed. The EWM is particularly suited to this task because it measures the relative dispersion of expert scores across indicators, assigning higher weights to indicators that exhibit greater variation (and thus carry more discriminating information).

The data for EWM were collected from the same panel of six experts introduced in Section 3.4.1 (three architects and three library science specialists). Each expert rated the importance of the nine indicator-layer factors (C1–C9) on a five-point Likert-type scale (1 = not important, 5 = very important). The resulting scores were organised into a raw data matrix:

$$X = (x_{ij})_{6 \times 9} \quad (1)$$

where $i=1,2,\dots,6$ indexes the experts and $j=1,2,\dots,9$ indexes the indicators.

Since all nine indicators are positive-directional (i.e., higher scores reflect greater importance), the range normalisation method was applied to eliminate dimensional

effects and render the scores comparable across indicators. The normalised value r_{ij} for each score x_{ij} was calculated as:

$$r_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (2)$$

Where $\min(x_j)$ and $\max(x_j)$ are, respectively, the minimum and maximum scores assigned to undicator j across all six experts.

Based on the normalised matrix, the entropy value e_j for each indicator j was computed as:

$$e_j = -\frac{1}{\ln 6} \sum_{i=1}^6 \mathcal{P}_{ij} \ln \mathcal{P}_{ij}, \quad \mathcal{P}_{ij} = \frac{r_{ij}}{\sum_{i=1}^6 r_{ij}} \quad (3)$$

With the convention that $\mathcal{P}_{ij} \ln 0 = 0$ if $\mathcal{P}_{ij} = 0$. The entropy weight w_j for indicator j was then derived as:

$$w_j = \frac{1 - e_j}{\sum_{k=1}^9 (1 - e_k)} \quad (4)$$

The resulting entropy-based weight vector for the nine sub-criteria is presented in Table 3, alongside the AHP-derived criterion-layer weights for direct comparison. The combined weighting scheme—AHP at the criterion layer and EWM at the indicator layer—ensures that the final evaluation reflects both expert domain knowledge and the intrinsic information structure of the empirical data.

The entropy weight for each of the nine sub-criteria was computed following the procedure described above. The resulting entropy-based coefficients are reported in Table 3.

Table 3. Indicator System and Weights for the Cultural Value of Library Architecture.

Goal	Criteria	w		Alternatives	w _j
A Cultural Value of Library Architecture	B1 Cultural Heritage	0.502	C1	Social Impact	0.066
			C2	Innovation in Material/Technology	0.212
			C3	Long-term Impact	0.079
	B2 Aesthetic Expression	0.208	C4	Innovation	0.172
			C5	Response to Site	0.083
			C6	Aesthetics /Visual Language	0.062
	B3 Functional Innovation	0.290	C7	Performance	0.057
			C8	Spatial Organization	0.057
			C9	Sustainability	0.212

4. Case Analysis and Semiotic Decoding

4.1. Introduction to the Library Buildings

From the twenty-three projects under investigation, three were selected as case studies on the basis of their typological representativeness: The Wanmu Caotang (1891, a Qing-dynasty study hall repurposed as a reformist academy), the Canton Sun Yat Sen Memorial Library (1933, a Republican-era public library), and the Guangzhou Library (2012, a contemporary media-rich cultural centre). These three cases —spanning the late imperial, Republican, and contemporary periods—are described below in terms of the three analytical dimensions that structure the

evaluation framework: morphological-aesthetic expression, cultural-semantic transmission, and functional-pragmatic performance (Figure 2).



Figure 2. Comparative Architectural Profile of Three Landmark Library Buildings in Guangzhou.

The Wanmu Caotang (originally the Qiu Family Study Hall, built 1804) is a brick-and-timber structure of 663 m², following the three-bay, three-hall ancestral-hall typology with two interior courtyards and a hard-gable roof. Morphologically, its spatial organisation—a strict axial procession through successive courtyards and halls—materialises the Confucian ritual order of hierarchical social relations and scholarly cultivation. Semantically, the building acquired its historical significance when Kang Youwei leased it in 1891 to found the Changxing Academy (later renamed Wancao Thatched Hall), which became a crucible of the Hundred Days' Reform of 1898. Its symbolic capital, therefore, resides not in its architectural originality but in its association with a pivotal moment of intellectual transformation. Pragmatically, the hall served as a site of collective learning and political incubation—a functional role that departed radically from its original domestic-ritual function as an ancestral shrine.

The Canton Sun Yat Sen Memorial Library (built 1928–1933, designed by Lingnan architect Lin Keming) occupies a 45 × 45 metre square footprint, with two-storey corner pavilions and a central octagonal double-eave pyramidal roof. Morphologically, it presents a studied synthesis: its exterior adopts the formal vocabulary of traditional Chinese palatial architecture, while its interior deploys a Western reinforced concrete frame structure [12]. This stylistic bricolage is semantically charged: it articulates the Republican era's aspiration to a new civic modernity—one that sought to reconcile national tradition with technological progress. Pragmatically, the building was designed as a public institution for mass enlightenment, a role it continues to perform today as the Sun Yat-sen Documents Library, now housing special collections of Republican-era materials.

The Guangzhou Library (Zhujiang New Town, designed 2012) is conceived around the motif of “a beautiful book.” Morphologically, its staggered, zigzagging layered composition evokes the accumulation of books and the sedimentation of historical culture, while incorporating the vernacular qilou (arcade) as a regional architectural signifier. Semantically, the design posits the library not as a monumental repository but as an open, layered landscape of knowledge—a gesture toward the democratisation of cultural access. Pragmatically, with a gross floor area of approximately 95,000 m², the building operates as an information-oriented, network-

integrated, and intelligent facility, serving as a multi-functional platform for reading, exchange, and leisure in the digital age.

4.2. Architectural Cultural Value Assessment

The integrated AHP-Entropy Weight Method model (Table 3) was applied to evaluate the three case-study buildings. For each building, the scores assigned to the nine sub-criteria were multiplied by their corresponding combined weights-calculated as the product of the criterion-layer AHP weights W_k (where $k=1,2,3$ indexes the three criteria B1–B3) and the indicator-layer entropy weights w_j (where $j=1,\dots,9$ indexes the sub-criteria C1–C9). These weighted scores were then hierarchically aggregated through weighted summation to produce both dimensional scores (Figure 3, Figure 4, Figure 5) and comprehensive scores (Table 4) for each building.

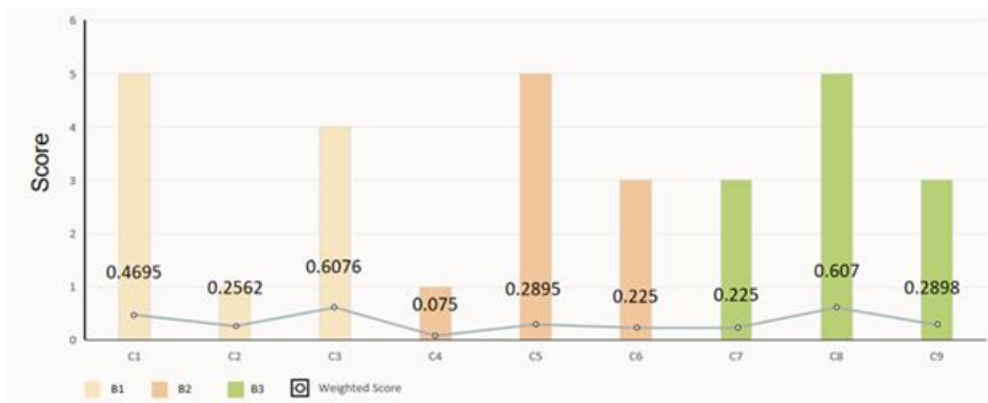


Figure 3. The Wanmu Caotang Evaluation Form.

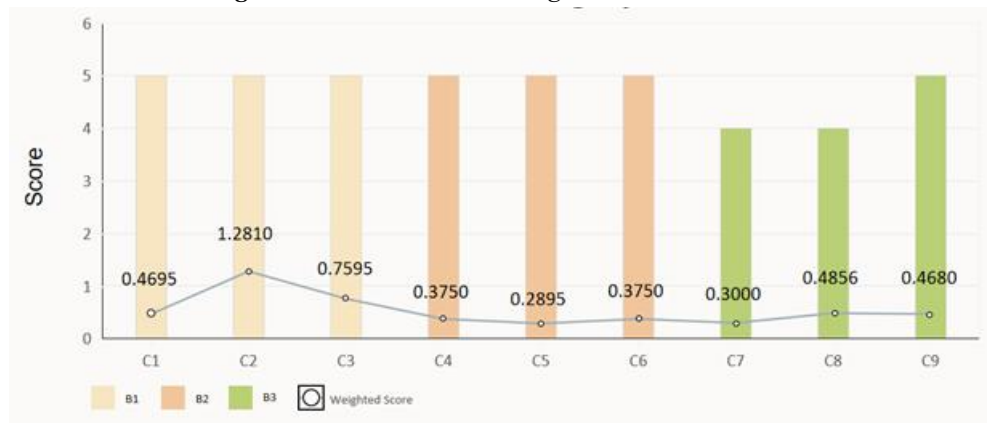


Figure 4. The Canton Sun Yat Sen Memorial Library Evaluation Form

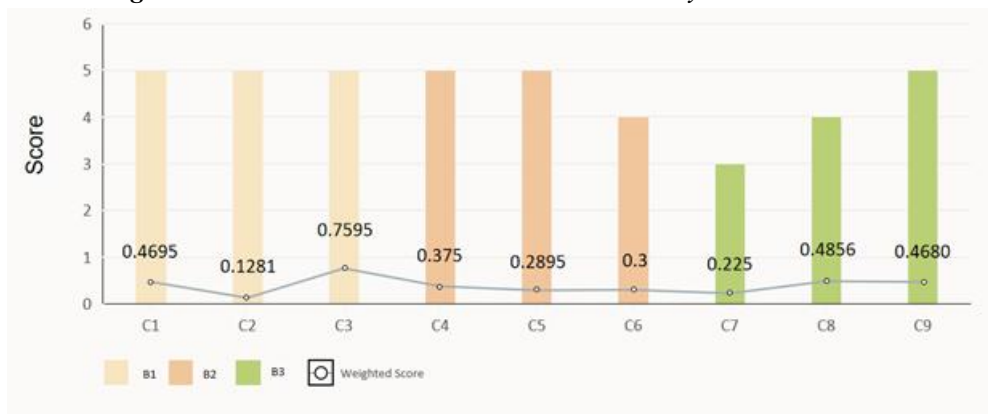


Figure 5. The Guangzhou Library Evaluation Form.

Table 4. *Cultural Value Scores of the Three Library Buildings.*

Criterion	Criterion Weight	Wanmu Caotang	Canton Sun Yat Sen Memorial Library	Guangzhou Library
B1 Cultural Heritage	0.502	1.3333	2.5100	2.5100
B2 Aesthetic Expression	0.208	0.5895	1.0395	0.9645
B3 Functional Innovation	0.290	1.1128	1.2536	1.1786
Total	1.000	3.0356	4.8031	4.6531

4.3. Overall Scores of the Three Cases

The results reveal a clear pattern of historical differentiation across the three analytical dimensions—morphological-aesthetic expression, cultural-semantic transmission, and functional-pragmatic performance. The Canton Sun Yat Sen Memorial Library(1933) scored highest in Cultural Heritage Transmission (4.5) and Aesthetic Expression (4.8), reflecting its deliberate synthesis of traditional Chinese palatial form with modern structural technology—a stylistic strategy that resonated with Republican-era aspirations for a distinctly Chinese civic architecture. Its Functional Innovation score (3.8), however, was comparatively modest, as the building's spatial configuration, while innovative for its time, was constrained by the monumental, ceremonial character expected of a public institution in that period.

The Guangzhou Library (2012), by contrast, scored highest in Functional Innovation (4.8), reflecting its design as a digitally networked, multi-functional platform for the contemporary era. Its Aesthetic Expression score (4.2) remains strong, owing to the distinctive visual identity generated by its layered, zigzagging composition and its integration of the vernacular qilou motif. Yet its Cultural Heritage Transmission score (3.5) is notably lower than that of the Republican-era library—a finding that points to the tension between the library's forward-looking digital-age function and its comparatively attenuated connection to historical architectural language.

The Wanmu Caotang (1891), as shown in Figure 3 , exhibits a distinctive profile that reflects its unique historical trajectory: its semantic-cultural value derives not from formal originality but from historical association—a mode of cultural transmission that the evaluation framework captures through its dimensional scoring rather than through formal-aesthetic criteria alone.

Across the three cases, a clear diachronic shift is discernible: from the Wanmu Caotang's historical-associative mode of cultural value , to the Republican library's synthetic-formal mode, to the contemporary library's functional-performative mode. Each building, in its own way, embodies a distinct configuration of the three evaluative dimensions—configurations that reflect not merely architectural choice but the broader epistemological and social conditions of their respective eras.

5. Discussion: Quantitative Analysis and Evolutionary Drivers

5.1. Comparative Analysis of Quantitative Performance

The comprehensive cultural value scores of the three library buildings exhibit a clear gradient: the Canton Sun Yat Sen Memorial Library (4.80) > the Guangzhou Library (4.65) > the Wanmu Caotang (3.04). The Republican-era library approaches the maximum score, the contemporary library demonstrates strong performance, while the late-Qing academy registers a notably lower score.

Across the three analytical dimensions, Cultural Heritage Transmission (B1) displays the greatest variation. the Wanmu Caotang achieves only 53.12% on this dimension, whereas the other two buildings both attain 100%. This disparity is primarily attributable to the sub-criterion Technological Innovation (C2)—which carries the highest weight (25.62%) among all sub-criteria. The Wanmu Caotang , lacking any significant structural or technological innovation, received the minimum score (1 out of 5). The Canton Sun Yat Sen Memorial Library, by contrast, received full marks for its structural synthesis—an architectural embodiment of the "Chinese substance, Western function" (zhongxue wei ti, xixue wei yong) paradigm. The Guangzhou Library likewise achieved a perfect score, owing to its distinctive tilted form and its integration of intelligent building technologies.

In terms of Aesthetic Expression (B2), The Canton Sun Yat Sen Memorial Library attained full marks, distinguished by its innovative “pavilion-within-pavilion” spatial configuration and its red-wall, green-tile palatial vocabulary. The Guangzhou Library received a high score for its “beautiful book” conceptual motif, though it was moderately penalised for a perceived lack of contemplative tranquillity—a quality traditionally associated with library spaces. The Wanmu Caotang scored lowest on this dimension, reflecting its conventional architectural typology and the absence of distinctive iconic elements.

The narrowest gap across the three buildings occurs in Functional Innovation (B3). The Wanmu Caotang received full marks on the sub-criterion Spatial Organisation (C8), yet its overall performance on this dimension lagged behind the other two buildings, constrained by the limited scope of its service provision and its weak performance on the sub-criterion Sustainability (C9).

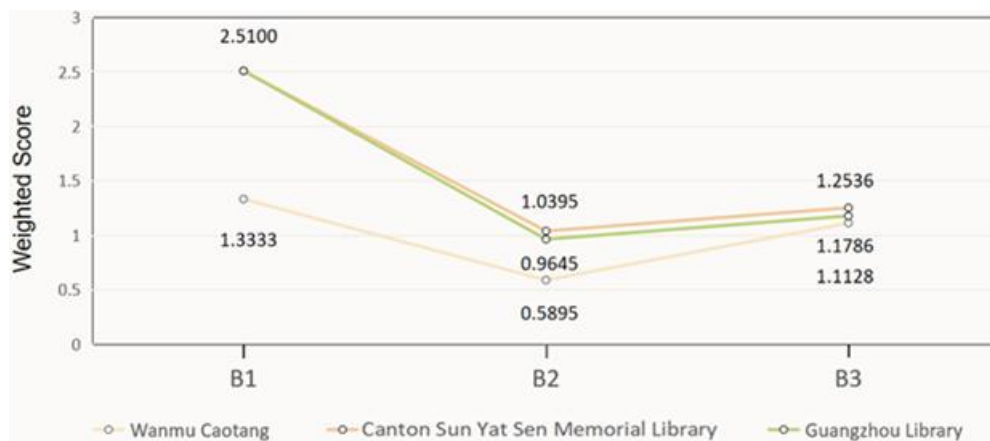


Figure 6. Comparative Table of Cultural Heritage Scores for Three Buildings.

5.2. Evolutionary Characteristics of Architectural Culture

Based on the three case-study buildings—the Wanmu Caotang(1891), the Canton Sun Yat Sen Memorial Library (1933), and the Guangzhou Library (2012)—the evolution of library architecture in Guangzhou exhibits three distinguishing characteristics:

(1) In terms of cultural expression: architectural culture has evolved from an introverted, conservative paradigm toward a vernacular-nationalist idiom, and ultimately to a contemporary landmark identity. The Wanmu Caotang represents an inward-looking, enclosed ancestral-hall academy. the Canton Sun Yat Sen Memorial Library responded to the Republican-era project of national rejuvenation through a “national form” (guoyou xingshi) architectural vocabulary. The Guangzhou Library, conceived through the motif of “a beautiful book,” has become an urban living room and a cultural landmark of the city. This trajectory is attributable to the introduction of Western notions of public librarianship, which catalysed the transformation of library buildings from closed repositories of texts to open cultural institutions serving the general public [13].

(2) In terms of social function: the building type has undergone a shift from elite education, to public enlightenment, and then to universal public service. The Wanmu Caotang served an exclusive circle of reform-minded elites. The Canton Sun Yat Sen Memorial Library pioneered the modern public library in Guangzhou. The Guangzhou Library now serves over ten million visitors annually across all age groups, ranking among the world’s largest and busiest libraries. This evolution was driven by sustained social transformation, which generated an increasing demand for “enlightening the masses and cultivating talent”—a demand that progressively repositioned the library as a social education centre .

(3) In terms of construction technology: the trajectory has moved from the continuation of traditional building techniques, to Sino-Western hybrid construction, and finally to independent innovation. The Wanmu Caotang perpetuated the brick-and-timber structural system of Qing-dynasty ancestral halls. The Canton Sun Yat Sen Memorial Library introduced Western reinforced-concrete frame construction. The Guangzhou Library, with its avant-garde tilted form, challenges the limits of structural mechanics—marking a decisive shift from learning from the West to independent innovation. This technological progression was enabled by the influx of Western engineering knowledge during the late Qing and Republican periods, which introduced modern materials and structural systems and thus propelled the transformation of architectural construction from tradition to modernity [14].

5.3. Development Trends in Library Architecture

Based on the foregoing analysis, three major development trends can be identified in the evolution of library architecture in Guangzhou:

Trend 1: Technological Integration. From natural ventilation and daylighting to intelligent building management systems, modern libraries have comprehensively adopted RFID, automated sorting systems, digital resource platforms, and related technologies. Among all evaluation indicators, technological criteria carry the highest weight (C2: Technological Innovation, 25.62%), underscoring its role as a core competency in contemporary library design and operation.

Trend 2: Functional Diversification. The library has evolved from a singular book-lending and -storage facility into an integrated urban public cultural complex encompassing reading, exhibitions, lectures, artistic appreciation, and social interaction. Spatial organisation has become increasingly flexible and open in response to this functional expansion.

Trend 3: Human-Centred Refinement. Despite the Guangzhou Library's technological sophistication, its user satisfaction score (C7) was only 3 out of 5—a

finding that exposes the challenges of noise management and seating availability under conditions of exceptionally high visitor volume. Future library development must strike a balance between technological advancement and human-centred user experience, shifting the focus from functional provision to experiential quality.

Taken together, the differentiated scores of the three buildings encapsulate the broader trajectory of Chinese architecture since the late nineteenth century—from the continuation of tradition, to transitional hybridity, to independent innovation. This historical sequence offers both a historical reference and a quantitative evidence base for the planning and design of contemporary library architecture.

6. Conclusions

This study has developed a hybrid “Semiotic-AHP Measurement” weighting framework for the multi-dimensional quantitative evaluation of three iconic library buildings in Guangzhou: The Wanmu Caotang (1891), the Canton Sun Yat Sen Memorial Library (1933), and the Guangzhou Library (2013). At the criterion layer, AHP determined the subjective weights of Cultural Heritage Transmission (B1: 0.502), Aesthetic Expression (B2: 0.208), and Functional Innovation (B3: 0.290). At the indicator layer, the Entropy Weight Method (EWM) was introduced to calibrate the nine sub-criteria (C1–C9), achieving an integrated synthesis of expert-led and data-driven weighting.

The study advances two principal contributions. First, it brings semiotic interpretation into dialogue with AHP's structured decision-making logic and EWM's empirical objectivity, constructing a composite evaluation model specifically calibrated to modern architectural heritage. Second, taking Technological Innovation (C2)—the highest-weighted indicator at 25.62%—as a critical lens, the study identifies the widest score differential among the three buildings on precisely this criterion, quantitatively mapping the technological trajectory of Chinese modern library architecture: from continuation of tradition, through Sino-Western hybridity, to independent innovation. This finding corroborates and extends the thesis that Chinese library architecture has undergone a fundamental transformation “from private custody to public service” [15].

It must be acknowledged that the score differential does not fully reflect the historical significance of the Wanmu Caotang. Rather, it reveals a deliberate orientation within the framework toward technological innovation as a primary metric of valuation—an orientation that is not a methodological weakness but a diagnostic feature, rendering explicit the evaluative priorities embedded in the model.

Looking forward, the framework is extensible to a broader architectural heritage corpus. Expanding the sample size would enable systematic validation of the weighting system's robustness. Ultimately, by establishing a quantitative conduit between the historical and the contemporary, this framework enables buildings from different eras to be measured against a unified scale—moving beyond retrospective classification toward a diagnostic, actionable understanding of architectural cultural value across time.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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