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An investigating on the ritual elements influencing factor of decorative art: based on Guangdong's ancestral hall architectural murals text mining

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Abstract

The gradual loss of certain good cultural genes in the traditional ritual system is, to some extent, driven by the value orientation of the art of ancestral hall decoration. This article uses wall paintings as a medium to uncover significant variables affecting the decorating of ancestral hall murals and to analyze the culturally formative relationships underlying their art from a ceremonial perspective. It depends on textual excavation. The analysis demonstrates that: (1) the 521 murals generally transmit positive content; (2) the shift in the painted figures' seating and grooming from formal to casual represents the fading of ceremonial concepts; (3) The control of economic costs may be a possible explanation for the large number of figures in crouching, skirting, and side-lying postures in wall paintings; (4) The fact that the colors employed in the garments of the figures from the Ming and Qing dynasties don't follow the folk color scheme demonstrates that the creative production at that time was not constrained by a lot of ritualistic considerations. The study concludes that the absence of an educational component in the arts is a contributing factor to the diluted nature of traditional rituals in modern China.

Keywords Guangdong Ancestral Hall, Mural art, Figures and colors, Patriarchal rituals, Text mining

Introduction

The issue of temple culture has received a lot of attention internationally [1]. Since the 2003 United Nations Convention for the Safeguarding of Intangible Cultural Heritage [2], cultural restoration has gained widespread acceptance among people [3, 4]. This convention

emphasizes the significance of the preservation of the "spirit of place," which contributes to the creation of emotional associations and consciousness bonds for an independent region and nation-state and is a key mechanism for the building of national strength. However, the thorough research up to this point has prompted us to reconsider some of the exogenous elements affecting clan cultural transmission, specifically the artistic presentation of ritual in the architectural decoration of clan shrines, which sets it apart from DeLyser and Greenstein's definition of cultural restoration (a relationship of material agency assumed by the clan shrine) [5].

Ancestral halls are challenged by cultural uniformity and loss as a result of urbanization [6]. The Guangdong government will pledge to restore around 1500 ancestral halls by 2020. However, it appears that the cultural restoration is driven more by the desire to change the

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site of ancestor worship and devotion into a more contemporary cultural production than it is by the need to preserve and transmit the culture of the clan shrines. The ritual economy of worship has been considered a byproduct of economic growth and an effective instrument for earning revenue [7, 8], while tourism has contributed to the multiplication and formalization of clan functions as well as the commercialization of religious activities and artifacts. There are currently 130,000 religious sites that serve as tourist attractions [9]. A strong desire for cultural authenticity is what drives the process of colorizing religious practices [10], and the essence of experiencing traditions should serve as the foundation for cultural transmission.

Ancestral halls were once thought of as essential tools of dominance [11]. Ancestral hall murals are a significant medium for presenting the materialization of the spirit of the past society, and in modern times, ancestral halls have emerged as cultural locations for exploring the social landscape of the past [12]. Mural painting takes on the responsibility of bridging the gap between the past and the present [13], and it does it by directly and traditionally expressing cultural values and societal ideals to the observer. The study of ancestral hall murals may help to uncover the formation of patriarchal relations behind the clan culture, and a few scholars such as Yan [14], Vucetic [15], Rolston [16], Źrałka [17], and Li [18] have paid attention to this aspect.

Yan [14] demonstrated how the mural art was relevant to the society behind it in his analysis of the murals at the Chen Family Ancestral Hall in Guangzhou. According to Vucetic [15], the development of ornamental mural painting in Colombia throughout the ancient time might shed light on the origins of current political connections. In his analysis of the history surrounding the mural's production, Rolston [16] pointed out several disparities in Chile in 1946 concerning national income, housing, and education. Źrałka [17] countered that the fictional elements of the frescoes might represent the artist's or the audience's desire for something beautiful, as Hu [19] demonstrated concerning the Guangzhou fresco "Fisherman, Woodcutter, and Cultivator," whose decorative elements and artwork frequently reflected the cultural identity of the area or nation and also had an educational purpose. Li [18] also highlighted the impact of painting schools and skills on the styles of mural painting.

As a result, current research reflects the cultural characteristics reflected in the ornamental art of shrine murals as well as the underlying principles of social evolution, such as elements of national history, geopolitics, and cultural geography. Right now. The rituals that shaped the Guangdong tradition of ancestral hall mural decorating have not been thoroughly studied. In actuality,

ritual analysis is among the most archaic aspects of traditional Chinese culture and one of the foundations of the country's power [1]. There is still more effort to be done to document Guangzhou's architectural murals, of which 4097 have been registered [18]. Several related works [20, 21] have provided detailed descriptions of the content of these murals, enabling additional investigation and serving as an essential foundation for our study.

This study aims to employ text mining techniques to elucidate the pertinent factors impacting the decorative art of ancestral hall murals in Guangdong and to unearth the manifestations of traditional ritualistic elements therein, thereby revealing the intrinsic correlation and interplay between the two, which imparts insights for the preservation, restoration, and cultural perpetuation of both tangible and intangible heritage. KH Coder, an emergent text mining tool conceived in 2014 [22], has been extensively deployed in domestic Japanese research endeavors, predominantly published in Japanese [23–26]. To date, only a scattering of English expositions elucidates the utilization of this tool [27, 28]. As a modality within the domain of computer science, the application of text mining in the cultural and artistic sphere has yielded scant results [29, 30]. This research proffers an innovative methodological framework and scientific grounding for the utilization of text mining to analyze unstructured artistic data, bridging computer science with the humanities and arts, thereby forging a novel avenue for the integrative analysis of culture and decorative art.

First, the chosen mural materials are manually sorted and classified; next, all the textual materials introducing mural paintings are chosen; next, a text mining algorithm should be used to elicit the relevant influencing factors of the decorative art of shrine mural paintings; finally, a correlation with patriarchal ritual culture is built using thematic clustering and cross-tabulation analysis. Finally, to understand the cultural formation linkages underlying the ornamental art of frescoes, the content of frescoes with an emphasis on figure topics is evaluated to determine influencing elements, and the results are remapped with socio-historical and cultural occurrences.

Research methodology

Data source and processing

The research material for this study originates from "Guangzhou Ancestral Hall Murals", volumes one and two, published in 2015 by Chinese scholar Liu Zhaojiang professor [20, 21]. The initial intention behind the creation of these two books was to systematically comb through and study the unique mural art found in ancestral halls in the Guangzhou region. As an art form that is both irreplaceable and susceptible to damage, murals must be documented and disseminated in forms such

as books. With the objectives of cultural preservation, academic research, and educational popularization, Liu Zhaojiang meticulously organized 521 artistically valuable ancestral hall murals. He cataloged the origins, content, artistic techniques, and characteristics of the murals, as well as their relationships to the ancestral halls they reside in, all in a form that combines text and imagery.

Only descriptive information about the murals will be extracted for analysis to concentrate on the theme. Information from the books, such as pictures, authors, dates of inscription, painting names, ancestral hall locations, and scroll specifications, will not be taken into account in the textual analysis stage. The team has compiled this data for analysis into an Excel document containing 521 groups of cell text before extraction. Second, in preparation for the ensuing coding study, the mural subjects and tale contents were divided into external variables Group A and Group B, and new list columns were created by

information filtering. The number of murals in groups A and B after coding is shown in Fig. 1 to demonstrate the impartiality of the coding procedure. Table 1 lists the original categorization of subjects and materials that were coded.

Research techniques and procedures

KH Coder, developed by Kosuke Akaishi’s team at Osaka University in Japan, is a text mining tool grounded on artificial intelligence algorithms [31]. This open-source software, purpose-built for quantitative content analysis, provides a suite of functionalities encompassing word frequency analysis, cross-tabulation, co-occurrence network, and multivariate analysis. Rooted in Natural Language Processing (NLP), KH Coder utilizes the R language algorithm [32] and MySQL [33] for data analysis. To date, it has been widely employed in over 900 projects for text collection [31] and quantitative analysis [34], spanning diverse domains such as linguistics [22],

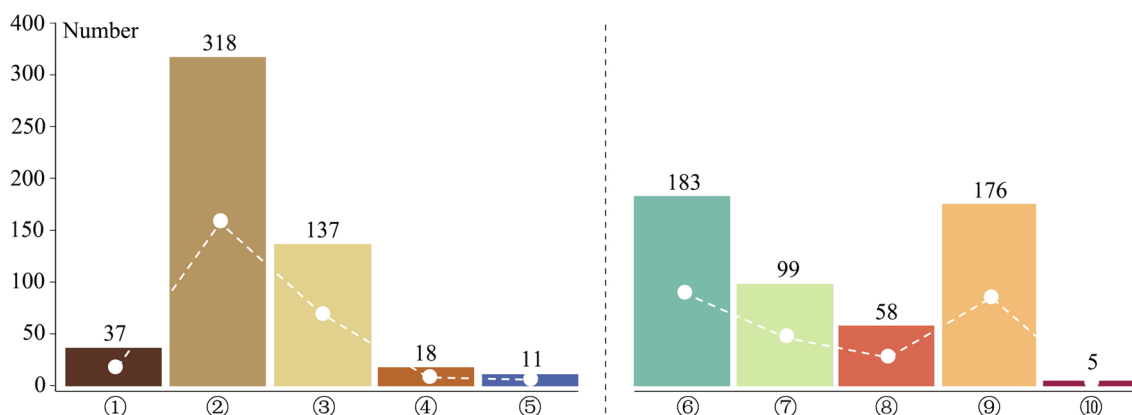


Fig. 1 Number of murals in groups A and B after selective coding

Table 1 Initial coding table for external variables group A and group B

Group A: topic selection/coding			Group B: content/coding		
Landscapes (a), Character scene (b), Flowers and birds (c), Portfolio pictures (d), Bird and beast (e), Plant (f), Flowers and birds-patterned (g), Flowers and birds and rare birds (h), People (i), Fish and insects (j), Scenes (k)			Aspiring life (a), Historical Allusion (b), Myths and legends (c), Beautiful yearning (d), Good luck (e), Harmonic allegory (f), Strive for prestige (g), Folk stories (h), Legendary stories (i), Fables (j), History people (k), Fisherman farming (l), Character image (m), Folklore (n), Life as a resident (o), Birds and flowers (p)		
Variable group A			Variable group B		
Code	Number	Component elements	Code	Number	Component elements
Scenery ①	37	a,k	Historical allusion ⑥	183	b, g, l
Character ②	318	b, i	Legendary story ⑦	99	c, k, h, n, j
Floral plant ③	137	c, f	Aspiring life ⑧	58	a, d, o
Portfolio pictures ④	18	d, g	Auspicious parable ⑨	176	e, f, p
Bird and beast ⑤	11	e, h, j	Celebrity story ⑩	5	k, m

anthropology [35], economics [36], and sociology [37]. The software’s strength lies in its objectivity. Its unstructured, robust analytical functionality is particularly adept at uncovering trends and characteristics [27].

Compared to ROST CM6 [38] created by Wuhan University in China, KH Coder boasts superior automatic word segmentation and word combination extension capabilities [31]. KH Coder supports multiple language analyses, including Chinese, English, Japanese, and Korean. Functions such as text segmentation, vocabulary integration, and knowledge graph construction are integrated into a single operating panel, making it user-friendly [32]. In comparison to a series of language processing toolkits developed based on the Python programming language by Wuhan University, which requires format conversion for compatibility (e.g., HanLP, THUCTC, SnowNlp), and only supports Chinese language, KH Coder presents a more advanced feature [39]. When performing word searches, KH Coder can trace back to all other variants of a term and locate its occurrence in the text, whereas Wordstat, developed by Provalis Research in Canada, can only retrieve the terms entered in the “search bar” [40].

This paper analyzes based on the below steps:

In the first step, Excel was loaded into KH Coder in the form of Stanford POS Tagger to pre-process the information, and check the merging of words in the word frequency list. The nonsense words, such as Be verbs, pronouns, and conjunctions, were then coded into “Force Ignore,” [41] while the semantics of other words were simultaneously checked and the words with fixed collocations were extracted and coded into “Force Pick up,” which was then run again. Following processing, the basic descriptive information was collected. Based on the procedure stated above, the filtered text data was made more

legitimate by verifying the word frequency list four times and updating the “Force Ignore” and “Force Pick up” word lists, and the calculation’s accuracy was enhanced (running speed from 53 to 48 s). When compared to the initial information processing results (Table 3), 3509 nonsensical words and 105 classes of related terms were effectively eliminated. The total number of sentences, paragraphs, and cells was 1273, 1273, and 523, respectively, after the words and word classes to be studied were efficiently decreased by 19,508 words and 739 classes with the use of KH Coder’s enhanced word processing feature. Figure 2 depicts the results of the four information processing procedures’ optimization.

In the second step, we calculate Term Frequency (TF) and Document Frequency (DF). Term Frequency (TF) represents the frequency of a given word’s appearance in a document. A high TF is generally considered to be highly correlated with the document’s theme. On the other hand, DF indicates the quantity of a given word in different analytical units, such as sentences, paragraphs, and cells. If a word only appears in a few documents, it could potentially be a key words for describing the themes of these documents. By employing Eq. 1 [42] and Eq. 2 [43], TF and DF are determined, respectively. As illustrated in Fig. 3, there are approximately 7056 terms with a TF < 10. These infrequently appearing terms, which constitute 95.57% of the data, are not adequately representative of the text’s value, hence are not included as main analysis targets. The analysis focus is confined to terms within the range of $10 \leq TF \leq 100$, designated as “Priority” level for subsequent study. It is also noteworthy that terms with exceedingly high TF may not necessarily be meaningful as they are mostly common words and may not be entirely characteristic or representative [44]. Consequently, terms with $100 < TF < 200$ are designated

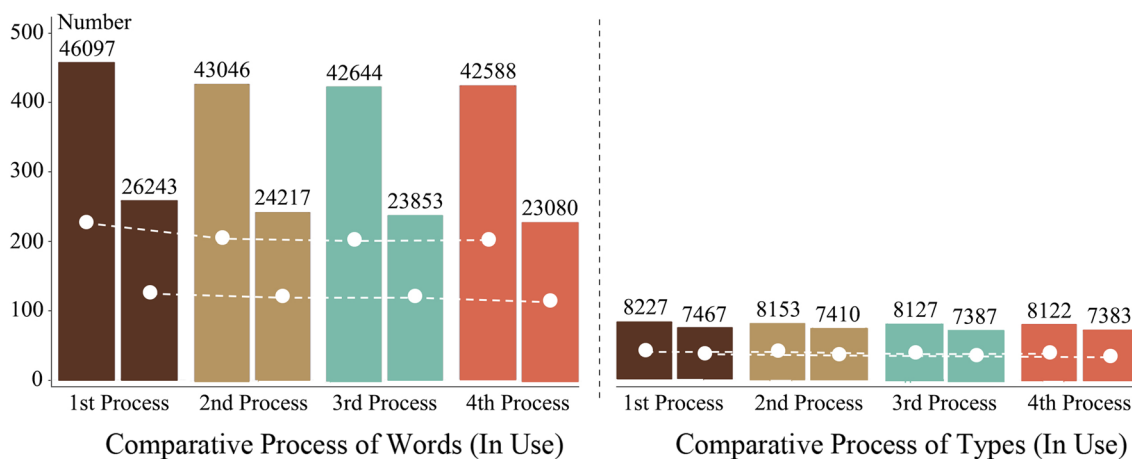


Fig. 2 Comparison of the results of the four data processing processed

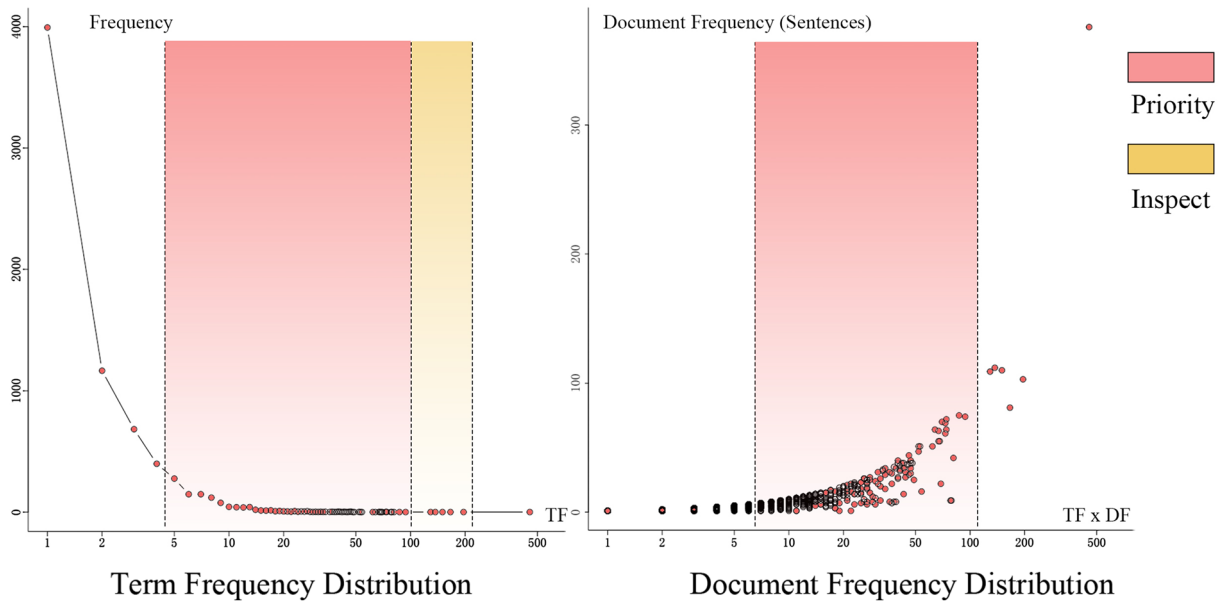


Fig. 3 Calculation results of TF and DF

as “Inspect” level, requiring semantic verification in subsequent research. There are 454 terms with $TF > 200$, typically closely related to the text theme but often appear in pronoun form and do not provide meaningful analysis, thus also excluded from the primary analysis target, making up 0.01% of the total. Therefore, by eliminating terms with exceedingly low or high TE, the total analysis workload is effectively reduced by 95.58%.

The $TF \times DF$ graph depicts the degree of positive correlation between the two metrics [45]. Statistics show that there are 371 terms with $TF \geq 10$. Due to space constraints, this paper only displays the top 100 terms, with a total TF of 3972. Nouns account for 60% of the data, verbs account for 31%, and adjectives make up 9% (Fig. 4).

$$TF(i) = \frac{\log_2(\text{Freq}(i,j)) + 1}{\log_2(L)} \tag{1}$$

$$\text{idf}_i = \log \frac{|D|}{|\{d : d \ni t_i\}|} \tag{2}$$

Word frequency statistics and topic coding

In the third phase, the data were normalised by weight conversion using (Eq. 3) [46], and the key influencing elements were elicited and their affective inclinations were determined using a word frequency descending table, in order to understand the social influence they brought. The frequency of word a in a data source is denoted as N_a , and the score N'_a is calculated by converting the

highest N_{\max} of word frequency in the data source that corresponds to a . Finally, a $TF \geq 5$ weighted statistics table is obtained (Table 2). Table 3 was created after the words in Table 2 were divided into groups based on their lexical characteristics and coded based on the semantics of the terms in the groupings.

$$N'_a = N_a \cdot 100/N_{\max} \tag{3}$$

Cross-tabulation and correlation construction

The fourth stage examines the possible influence link between topic groups by counting the text proportion for each subject group in Table 3 according to coding standards and comparing the numbers. The subject groupings with greater weights typically exhibit better correlations within the same text data. The uncompiled text will be categorized as “Other,” and the word groupings without a trend or feature will not be discussed in this paper’s percentage graph.

The statistics (Fig. 4) show that among the classified emotional elements, “character” (24.95%) has a greater proportion and that there is a strong link between it and “action verbs” (4.72%). It is feasible to conclude that the murals largely represent positive content when paired with the emotional values in Table 6, with the “Life Allegory” (5.03%), “Fame and Fortune” (4.72%), and “Health” (2.53%) components reflecting the pleasant things that people want in their life [47]. There are two groups for these great sights. The first kind is the pursuit of immaterial things like “Poem (诗),” “Moral (道德),” “Life (生活),” and other phrases that describe

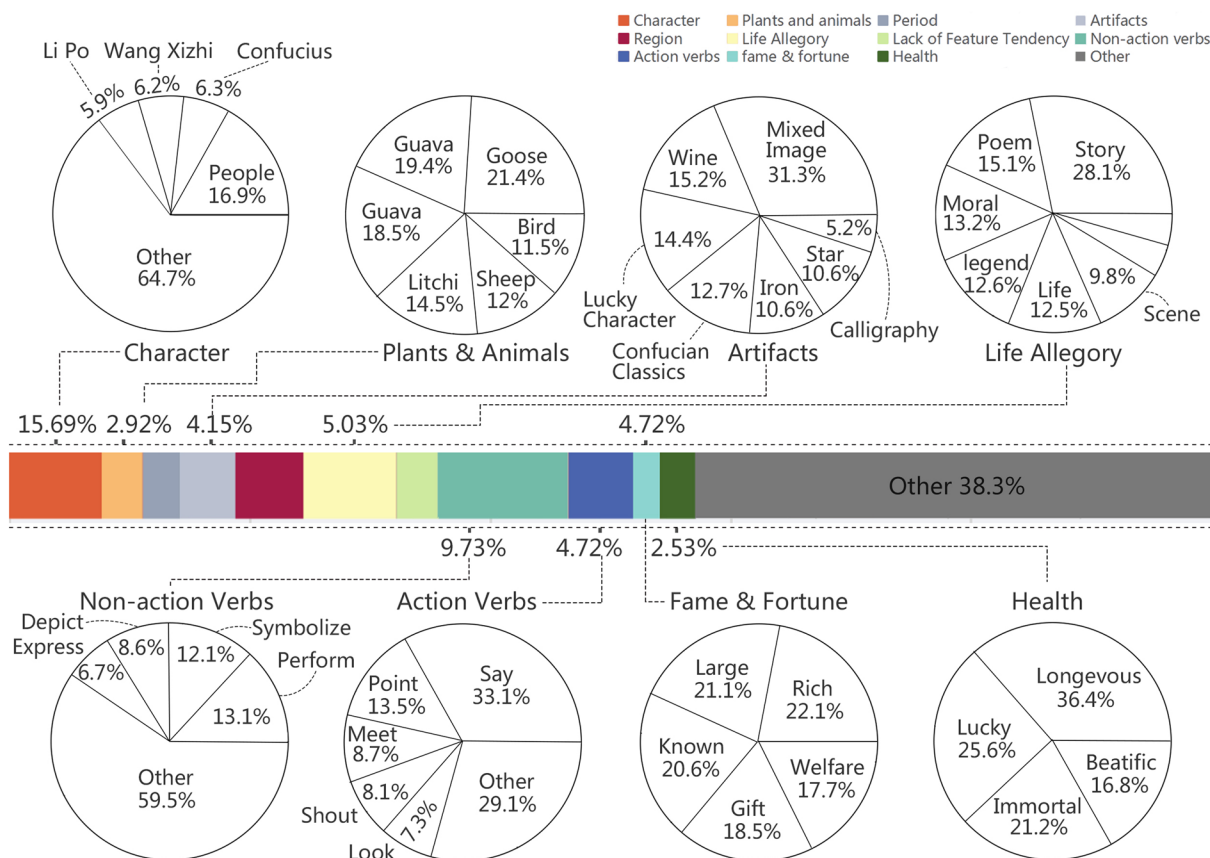


Fig. 4 Content data statistics for different impact element groups

the literati and affluent people’s way of life. The desire for material life is the opposite, as expressed by phrases like “Welfare (福利),” “Rich (富有),” “Longevous (长寿),” “Lucky (幸运),” and “Beatific (幸福),” which all allude to the pursuit of fame and fortune [48]. Because Guangdong has long been a commercial city, it may be inferred from comparisons that people in ancient Guangdong were more keen to pursue fame and money [49]. Additionally, while “Plants and Animals” (2.92%) and “Artifacts” (4.15%) occupy low weights, “Non-action Verbs” (9.73%) occupy a medium degree of influence, reflecting the indirect and metaphorical logical relationship of information transmission of the mural content [50]. It can be assumed that the decoration of flowers, plants, and household utensils in the mural may play an allegory [51].

In conclusion, three themes—figure form and rhyme, artifact metaphor, and value transmission—can be widely categorized as ceremonial influences on the art of Guangdong ancestral hall paintings. Due to space constraints, this study concentrates on the primary topic of 318 murals, which primarily depict characters;

the other two themes will be covered in a later set of studies.

The ritual component of the decorative art of Guangdong ancestral hall murals

The evolution of sitting and lying reflected in the figure’s form and rhyme—reflecting the dynamic change of etiquette from respectful to natural

The change in the sitting and lying of the figures in the mural—from formal to relaxed ritual dynamics, to a certain extent reflects the dilution of patriarchal ritual thinking, reflecting the popular aspects of mural art, driven by the policy direction. The combined sitting posture (one leg straight and the other bent at the knee or in a frontal or lateral shape) [52] is depicted in 251 (79%) of the 318 ancestral hall murals (Table 4), whereas the traditional kneeling posture (serious and respectful monarch and minister etiquette) [53] is less common. This is quite different from the dignified sitting posture that was emphasized by traditional rituals in the past. Policy guidance may have been one of the important factors contributing to this change in dynamics. The earliest appearance of the figures seated on pedestals and in the sitting position can

Table 2 Feature words with frequency top 100

No.	Word and part of speech	Freq.	Goal	Num	Word and part of speech	Freq.	Goal		
1	Person (人)	n	196	100	51	Society (社会)	n	38	19.4
2	Say (说)	v	166	84.6	52	Study (学)	v	38	19.4
3	Story (故事)	n	150	76.5	53	Literary People (文人)	n	37	18.9
4	China (中国)	n	137	69.9	54	Li Jing (李靖)	n	37	18.9
5	Ancient (古代)	n	129	65.8	55	See (看)	v	37	18.9
6	Perform (表现)	v	94	48	56	Genty (礼)	adj	36	18.3
7	Represent (象征)	v	87	44.4	57	Drink (饮酒)	v	36	18.3
8	Pattern (图案)	n	81	51.3	58	Nation (国)	n	34	17.3
9	Folk (民间)	n	79	40.3	59	Beatific (幸福)	adj	34	17.3
10	Poem (诗)	n	78	39.8	60	Fortune (禄)	adj	34	17.3
11	Longevous (长寿)	adj	74	37.7	61	Tang Dynasty (唐代)	n	33	16.8
12	Confucius (孔子)	n	74	37.7	62	Prince (太子)	n	33	16.8
13	Wang Xizhi (王羲之)	n	73	37.2	63	Xi Wangmu (西王母)	n	32	16.3
14	Human (人们)	n	73	37.2	64	Ask (问)	v	32	16.3
15	Portfolio Pictures (组图)	n	70	35.7	65	Culture (文化)	n	32	16.3
16	Calligraphy (书法)	n	69	35.2	66	Scripture (经书)	n	31	15.8
17	Point (指)	v	68	34.7	67	Lychee (荔枝)	n	31	15.8
18	Implication (寓意)	n	67	34.2	68	World (天下)	n	30	15.3
19	Li Bai (李白)	n	67	34.2	69	White Haired (白头翁)	n	30	15.3
20	Legend (传说)	n	64	32.6	70	Love (喜欢)	v	30	15.3
21	Depiction (描绘)	v	62	31.6	71	Become (成为)	v	29	14.8
22	Life (生活)	n	54	27.5	72	Come (来)	v	29	14.8
23	Master (主人)	n	53	27	73	Lmmortals (仙人)	n	28	14.2
24	Auspicious (吉祥)	adj	52	26.5	74	Eight Immortals (八仙)	n	28	14.2
25	Fairy Crane (鹤)	n	52	26.5	75	ancient people (古人)	n	27	13.8
26	Daoist priest (道士)	n	49	25	76	Guest (客)	n	27	13.8
27	Express (表达)	v	48	24.4	77	Family (家)	n	27	13.8
28	Scene (情景)	n	47	24	78	Lingnan (岭南)	n	27	13.8
29	Bless (福)	n	47	24	79	Su Dongpo (苏东坡)	n	27	13.8
30	Poet (诗人)	n	47	24	80	From (出自)	v	27	13.8
31	Luck (祝寿)	v	47	24	81	Disseminate (流传)	v	27	13.8
32	Compose (组成)	v	46	23.4	82	Propagate (相传)	v	27	13.8
33	Harmony (谐音)	n	46	23.4	83	Male (先生)	n	26	13.2
34	Can (可以)	v	46	23.4	84	Reflect (反映)	v	26	13.2
35	Posterity (后人)	n	45	23	85	Star (星)	n	26	13.2
36	View (见)	v	44	22.4	86	Sheep (羊)	n	26	13.2
37	People (人物)	n	44	22.4	87	Indicate (表示)	v	25	12.7
38	Fairylike (仙)	adj	43	22	88	Iron (铁)	n	25	12.7
39	Wealthy (富贵)	adj	43	22	89	Like (如)	v	25	12.7
40	Offspring (子孙)	n	43	22	90	Reading (读书)	v	25	12.7
41	Garnet (石榴)	n	42	21.4	91	Reason (道理)	n	25	12.7
42	Called (称为)	v	41	21	92	Bird (鸟)	n	25	12.7
43	Shout (叫)	v	41	21	93	Delegate (代表)	v	24	12.2
44	Big (大)	adj	41	21	94	Write (写)	v	24	12.2
45	Period (时期)	n	40	20.4	95	Place (地方)	n	24	12.2
46	Later (后来)	n	40	20.4	96	Chancellor (宰相)	n	24	12.2
47	Peony (牡丹)	n	40	20.4	97	Metaphor (比喻)	n	23	11.7
48	Known (著名)	adj	40	20.4	98	Know (知道)	v	23	11.7

Table 2 (continued)

No.	Word and part of speech		Freq.	Goal	Num	Word and part of speech		Freq.	Goal
49	Liquor (酒)	n	39	20	99	Think (认为)	v	23	11.7
50	Koi (孔鲤)	n	39	20	100	Pursuit (追求)	v	23	11.7

Table 3 Semantic classification of words in Table 2

Type	Noun (2987)	Verb (1067)
Group	Character(Person, Confucius, Wang Xizhi, Human, Li Bai, Master, Daoist priest, Poet, Posterity, People, Offspring, Koi, litterateur, Li Jing, Prince, Xi Wangmu, White Haired, Immortals, Eight Immortals, ancient people, Su Dongpo, Gentleman, Chancellor, Guest) Plants and Animals (Garnet, Peony, Lychee, Goose, Sheep, Bird) Period (Ancient, Later, Tang Dynasty) Artifacts (Iron, Star, Scripture, Liquor, Beatific, Calligraphy, Portfolio Pictures) Region(Lingnan, China, Folk, Society, Family) Life Allegory (Legend, Story, Poem, Implication, Life, Scene, Metaphor, Reason) Other (Pattern, Harmony, Nation, Culture, World)	Non-action Verbs (Perform, Represent, Depiction, Express, Luck, Compose, Can, Called, Study, Love, Become, From, Disseminate, Propagate, Reflect, Indicate, Like, Delegate, Know, Think, Pursuit) Action Verbs (Say, Point, View, Shout, See, Drink, Ask, Come, Reading, Write)
Goal	1500.5	672.9
Effect Degree	Character (591.1) → Plants and Animals (259) → Region (157.2) → Artifacts (156.6) → Plants and Animals (110) → Period (103) → Other (123.6)	Non-action Verbs (417) → Action Verbs (255.9)
Type	Adjective(338)	
Feature Word and Freq	Longevous (74), Auspicious (52), Fairy-like (43), Wealthy (43), Big (41), Known (40), Genty (36), Beatific (34), Fortune (34)	
Group	Fame and Fortune (Genty, Fortune, Wealthy, Big, Known) Health (Longevous, Auspicious, Fairylike, Beatific)	
Goal	202.5	
Effect degree	Health(101.5) → Fame and Fortune (99)	

















be traced back to Ming dynasty murals of ancestral halls [21], and in 1536 Ming Jiajing decreed that “all folk are allowed to establish temples” [54], which led to a boom in the construction of ancestral halls and the appearance of urban ancestral halls in the public eye. The pursuit of freedom and open-mindedness in the city, as well as the cultural influence of emancipation promoted by “Western learning” [55], made it difficult for the traditional stereotypical fresco figures to satisfy the aesthetic needs of the public, which led to the diversification of fresco figures.

Figure 5 displays, for 315 of the figure murals (excluding the three murals with lacking dimensional data), the relationship between the scale of the painting and the dynamic postures of the figures in the painting. Four characteristics are reflected in the figure: (1) The width

of these murals averages 100 cm, and the vast majority of them have a length-to-width ratio of more than 2:1; (2) The proportions of about 15 frescoes are on the square side, and most of the figures in these frescoes are in a standing position; (3) Murals larger than 2:1 in length almost always have non-standing figures in pose; (4) The bulk of the 1318 painted figures are in the standing posture and frequently appear in conjunction with seated and reclining individuals, with a minor number of crouching and kneeling figures.

The effect of speedy and efficient artistic creativity spurred by the necessity to accomplish a large assignment may be the shift of the painter from a restrained to a loose brush technique. To outline a vivid and aesthetically harmonious picture full of figures within the limited space of the painting, the lower half of the figure

Table 4 Changes in the sitting and lying movements of figures in the murals of Guangdong ancestral halls

Kneeling				
Name	Poetry and Rituals in the Family (诗礼传家)	Untitled (无题)	Huang Shi Gong meets Zhang Liang (黄石公见张良)	Fighting wine picture (斗酒图)
Position	Luo Xian Village, Team 2 and 3, Shen Chi Lu Gong Ancestral Hall	Chao Bo Zhang Gong Ancestral Hall of Duck Lake Village, Tan Bu Town	Chini Township, Liantang Village, Twelve Community Maoying Lu Gong Ancestral Hall	Zhong Ancestral Hall of the 14th and 15th Communes of Liantang Village
Description	Teach your son to learn poetry	Praying for blessings	Visiting Friends	Drinking for fun
tarsus sitting				
name	Group of immortals to be happy (群仙要乐)	Drunkenness of senior officials (高官醉酒)	Wonderful pen in geese (妙笔在鹅群)	Three Stars of Fortune and Longevity (福禄寿三星图)
Position	Ancestral Hall of the Lee Clan in Hesi Village, Chini Town祠	Luo Xian Village, Team 5 and 6, Jia Ru Lu Gong Ancestral Hall	Bi Ancestral Hall of Dong'an Society, Jiutan Village	Lai's Ancestral Hall, Ha Shiyuan Natural Village, Hoa Sai Village
Description	Gathering for fun	Drinking for fun	Poetry and painting	Eat, drink and be merry
Skip sitting				
name	Ji Qin Ruan Xiao (嵇琴阮啸)	The Eighteen Grand Masters-1 (十八大学士-1)	Voluptuous Lady Preaching Scripture-1 (伏女传经-1)	Voluptuous Lady Preaching Scripture-2 (伏女传经-2)
Position	Huang's Ancestral Hall in Shawan Natural Village, Chini Village	Liang Ancestral Hall, Gangtuo Natural Village, Xibian Village	Chini Town Lantian Village Tingfang Li Gong Ancestral Hall	Yao's Ancestral Hall in Shorling Natural Village, Ruiling Village
Description	Fiddle and play music	Tea Drinking Exchange	Teach the Scriptures	Teaching Scripture
Other sitting positions				
name	Blessings from Heaven (福自天来)	The Eighteen Grand Masters-2 (十八大学士-2)	The Three Wind and Dust Men (风尘三侠)	Four Hao of Shang Shan (商山四皓)
Position	Xinhua Street Sanhua Village Heng Zhi Xu Gong Ancestral Hall	Guo's Ancestral Hall, Twelve Communes, Tanggang Village, Chini Town	Huang Clan Ancestral Hall, Wushi Village, Chini Town	Chaoyuan Zhang Gong Ancestral Hall, Xinya 3rd Team, Ha Lianzhu Village
Description	Curled knees and half-lying	Light Squat	half tarsus sitting and half skip sitting	Full Squat

Due to the limited space, this table only shows the typical and representative sitting and lying postures

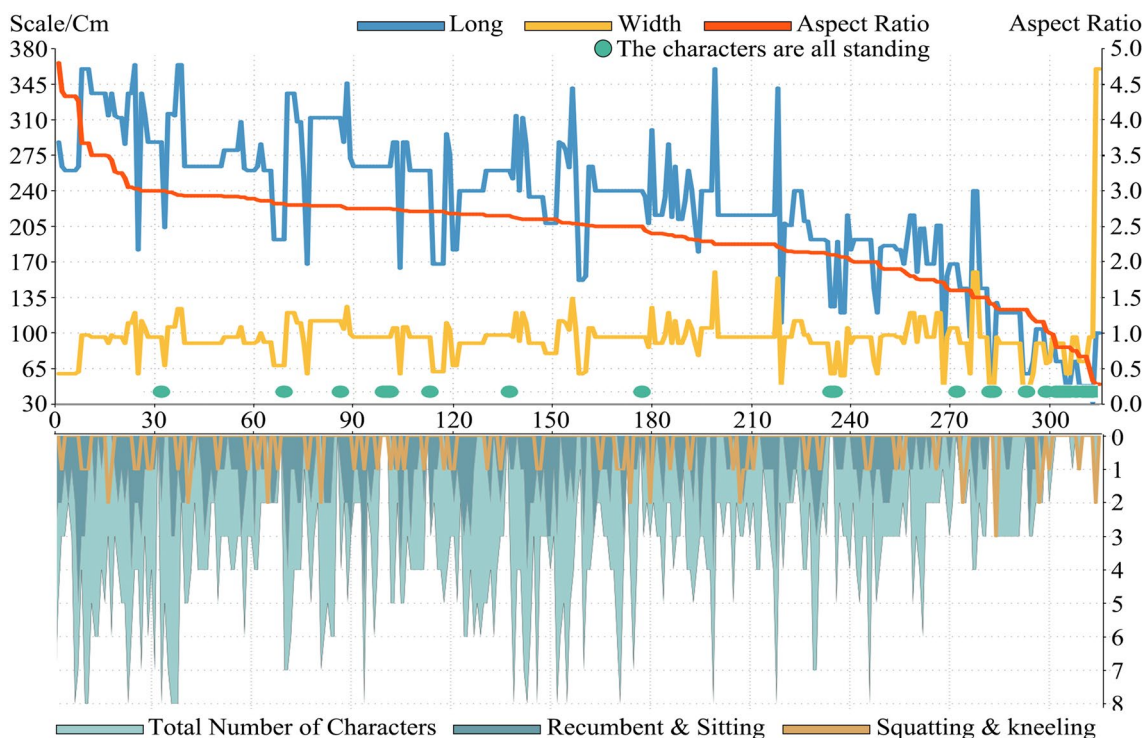


Fig. 5 Proportional analysis of the painting scale and statistics of the number of seated positions of the wall paintings in Guangdong ancestral halls

is treated as seated and reclining, which can effectively reduce the imbalance brought by the vertical proportion of the figure to the composition of the long scroll, and this may be a possible explanation for the presence of almost all of the figures in the nearly 200 3:1 long scroll wall paintings in such postures as crouching and reclining. Due to the scarcity of relevant historical information, more evidence is still needed to prove this point.

The ethics of the rules and regulations embodied in the use of colors in costumes—reflecting the change of thought from feudalism to openness

To some extent, the change in the color performance of the characters’ costumes in the mural reflects the social changes in Guangdong in the nineteenth century, from the ethics of the program to the society’s open-mindedness, primarily in the use of color from positive color performance to inter-color performance.

























The positive color refers to the five pure colors of blue, red, yellow, white, and black (as well as additional pure colors that do not blend) [56], while the inter-color refers to the color that is blended with several positive colors. There were severe ceremonial limits on the usage of colors in ancient China, and positive colors and inter-colors were instruments to distinguish the noble and humble and were not to be blended in any way [57]. The

color was also employed to denote authority and position in official attire [58]. Purple was once thought to be a lowly hue as an inter-color. According to Confucius, Garments characterized by an amalgamation of red and purple hues were exclusively designated for the attire of the common populace [57], reflecting the society’s concept of self-control and class differentiation.

In terms of color expression (Table 5), 181 murals (57% of the 318 murals) are represented via positive colors, whereas 137 (43% are expressed through intercoolers). In terms of color expression representing the connection between figures, 149 murals (46.8%) depict the order of inferiority, while 169 (53.2%) show the condition of nature and equality. The quantitative statistics show that the frescoed figures are essentially equal in their portrayal of both contents, but when we examine the time context, this does not match the Ming Dynasty’s clothing color standards [59]. However, the content of the murals may not be a complete representation of social phenomena, since the content of paintings is generally a side reflection of the creator’s inner ideas and goals [60], and may also reflect a portion of societal trends [61].

A large number of positive colors such as blue, white, yellow, and black are used to represent the figures in the 318 murals, but some of the murals also portray the figures brightly and subtly, with red and yellow hidden and glowing through the colorful, harmonious, and

Table 5 Comparison of the color scheme of the mural scrolls and characters in the Guangdong ancestral hall

No.	a				b				c			
Mural												
Color code	R210 G178 B147	R55 G40 B30	R238 G216 B211	R124G 82 B250	R231 G214 B207	R53 G52 B47	R170 G135 B110	R118 G86 B70	R221 G213 B205	R59 G63 B71	R128 G148 B192	R211 G177 B127
Color												
Color code	R131 G104 B82	R144 G127 B106	R178 G135 B56	R103 G75 B69	R199 G170 B144	R140 G107 B79	R157 G137 B134	R154 G149 B142	R110 G85 B72	R143 G117 B83	R168 G186 B172	R167 G133 B115
Charac ter												
Name	Full happiness and longevity (福祿寿全)				Figure of People (人物图)				Jian Tong Feng Di (剪桐封弟)			
Position	Chini Town Tianxin Village Jiaxiang Maigong Ancestral Hall				Maoying Lu Gong Ancestral Hall, Lian Tang Village, Twelve Communes				Luo Xian Village, Team 5 and 6, Jia Ru Lu Gong Ancestral Hall			
Color code	R214 G187 B164	R55 G40 B30	R114 G75 B54	R137G 110B9 2	R232G 219B2 16	R55G4 4B36	R152G 130B1 13	R106G 86B70	R217G 197B1 73	R56 G61 B75	R128 G148 B192	R169 G144 B111
Color												
Color code	R242 G229 B223	R154 G99 B62	R190 G141 B100	R146G 133 B121	R133G 105B7 9	R195G 171B1 54	R153G 144B1 42	R91G9 2B82	R216G 217B2 34	R108G 86 B70	R142 G117 B77	R162 G139 B138
No.	d				e				f			
Mural												
Color code	R228 G230 B226	R173 G185 B181	R33G 45B41	R146G 146B1 37	R56G4 9B49	R232G 223B2 22	R112G 83B62	R130G 123B1 26	R32 G22 B21	R205 G151 B116	R233 G221 B219	R84 G49 B36
Color												
Color code	R113 G125 B121	R148 G160 B167	R94G 95B87	R92G1 04B11 1	R153G 117B7 4	R167G 140B1 30	R177G 172B1 75	R200G 169B1 35	R97 G83 B75	R136 G112 B99	R239 G206 B167	R168 G84 B39
Charac ter												
Name	Sunshine book map (晒书图)				Samsung Chart (三星图)				Drunken Music in Penglai (蓬莱醉乐图)			
Position	Ancestral Hall of the Chen Clan in Bai Eel Tong Natural Village, Guangtang Village				Ancestral Hall of Ouyang Clan in Wuxing Village, Huashan Town				Liantang Village, four, five community Wenzhan Luo Gong Ancestral Hall			
Color code	R36G 44B44	R224 G227 B225	R114 G123 B122	R90G8 7B82	R46G4 0B43	R229G 213B2 13	R106G 74B48	R154G 113B6 3	R196 G163 B135	R31 G23 B23	R81 G56 B45	R89 G203 B191
Color												
Color code	R110 G107 B87	R147 G143 B135	R161 G171 B171	R159G 160B1 43	R123G 115B1 23	R161G 131B1 21	R200G 164B1 23	R168G 162B1 71	R232 G224 B223	R127 G91 B53	R141 G103 B85	R237 G213 B183

soft intercoolers—in contrast to the dark, serious, and restrained figures shown in positive colors. These inter-color representations of frescoed figures reflect the fact that the painters at the time were not heavily influenced by class feudalism in their paintings, and the rounded figures also reflect the central idea of human-centeredness and more affirmation of human value and dignity, reflecting the social change of traditional thought.

Perceptual evaluation of murals contents based on semantic differential method

In terms of artistic representations, the textual analysis derived the following results: the subject matter, allegory and content delivery of the Guangdong Ancestral Hall Architectural Murals mostly showed positivity. To validate the above results, this paper will use the Semantic Differential (SD) Method and the Delphi method for perceptual assessment of Mural Content.

Constructing evaluation scales

The semantic Differential (SD) method [62] (also known as the Sensory Recording Method), is a psychometric method proposed by Osgood in 1957, which aims at the psycho-perceptual measurement of subjects' speech scales. In this paper, the SD method will be taken to investigate the perceptual evaluation of 318 figure murals. The paper will then be evaluated on five dimensions (Color Scheme, Brightness, Composition, Character Depiction, and Theme), and the evaluation process involves constructing scales and asking participants to complete surveys. Referring to the evaluation form of the Likert Scale, authors assigned a more relevant -Negative Adjective Pair to each mural, and participants were required to make evaluations based on psychological feelings. The evaluation is divided into five indicators (with different scores set for each indicator), namely Close to positive adjectives-5 Score, Comparatively Closer to positive adjectives-4 Score, Neutral-3 Score, Comparatively Closer to negative adjectives-2 Score, Close to negative adjectives-1 Score. Table 6 shows an example of an evaluation table for Murals Contents.

Evaluation process

Drawing on the Delphi method [63], this study invited nine experts in related fields to appreciate and evaluate a sample of 318 murals. The subjects' professional fields are art history scholars, art anthropology professors, postdoctoral fellows in tourism architecture, visual communication designers, environmental design and color research scholars, Ph.D. in Chinese language and literature, and Ph.D. in fusion design. These experts have expertise in history, art history, anthropology, color

psychology, and environmental psychology, making the assessment results more scientific.

The evaluation process was divided into three steps. In the first step, basic information such as the purpose of the evaluation, the background of the study, and the data sources were explained to the subjects the use of the SD questionnaire was shown, and then the experts were guided to complete the questionnaire. In the second step, after all the questionnaires were collected, the evaluation opinions were counted and the variance of the Average Score for each Evaluation Indicator of murals was calculated. A variance greater than 1.5 was used as the threshold for divergent opinions. When the variance is greater than 1.5, it means that the experts' opinions are inconsistent, while when the value is less than 1.5, it means that the experts' opinions are consistent. In the third step, the experts were invited to conduct a second round of evaluation on the evaluation indicators with inconsistent opinions and identify the evaluation indicators with variance greater than 1.5. Then, communicate with the experts who gave the evaluation extremes and understand the reasons for the results. This process avoids generating extreme values as much as possible and makes the statistical results consistent [64]. Table 7 counts the adjective's word pairs. That have appeared in the SD scale.

Evaluation results

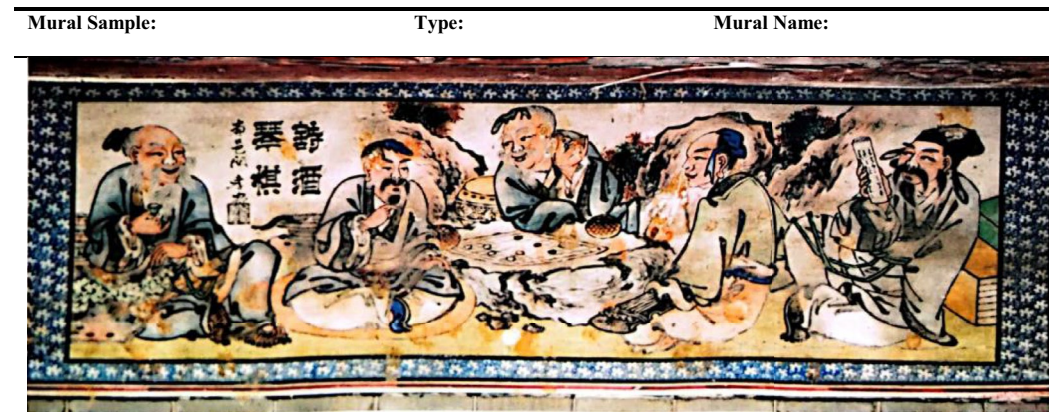
First, all the Evaluation Indicators made by 9 experts were counted and the Average Score was calculated, the Average Score was counted for the Evaluation Indicators in each category of murals. Table 8 shows the statistical results. With the help of the SD scale, the range of positive and negative score division is clarified and the Delphi method helps to focus the expert opinion. When the Average Score is greater than 3, it can represent that the delivery content of that type of mural is positive in some dimension [65].

In Fig. 6, the Average Score of the five categories of FIGURE MURALS for the five Evaluation Indicators can be seen. Historical Allusion's Character Depiction has an Average Score of less than 3 (within the blue pentagon), representing the negative nature of the content being communicated. Correspondingly, all other Indicators have Average Scores in the range of 3–4.5. It represents that the content delivered has a positive direction. The results of this analysis validate that the content of Guangdong Ancestral Hall Architectural Figures Mural Painting generally conveys positive emotional value.

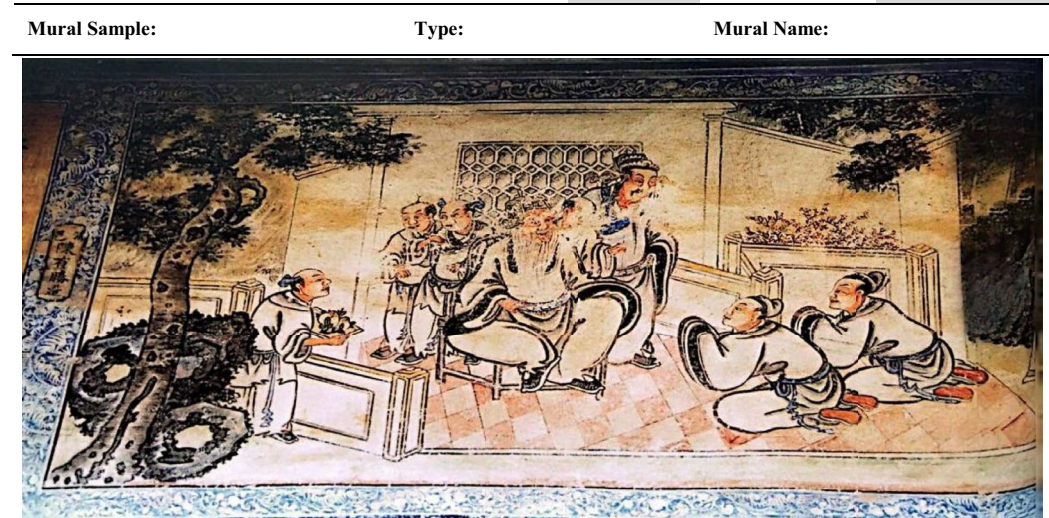
Discussions

As a vehicle for visual narratives, murals function as Educationality, Familiarity, and Sociability. Table 9 highlights the consensus of relevant studies: (1) Murals are

Table 6 Examples of perception evaluation forms for murals contents



Mural Title	Basic information	Evaluation Dimensions	Positive Adjectives	5	4	3	2	1	Negative Adjectives
Poetry, wine, qin, and chess	Inscription in 1887, measuring 260cm in length and 98cm in width; depicting scenes from the lives of ancient literati and scholars.	Color Scheme	Harmonious						Abrupt
		Brightness	Bright						Dim
		Composition	Balanced						Imbalanced
		Character Depiction	Lively						Stiff
		Theme	Elegant						Mundane



Happiness, prosperity, and longevity	Inscribed in the year 1893, measuring 336cm in length and 98cm in width; depicting a scene of people kneeling and paying homage to the deities Fu, Lu, and Shou.	Color Scheme	Harmonious						Abrupt
		Brightness	Bright						Dim
		Composition	Balanced						Imbalanced
		Character Depiction	Delicate						Rough
		Theme	Enthusiastic						Dismal

Table 7 Adjective word pairs that appeared in the SD scale

Evaluation indicators	Evaluative word pairs
Color scheme	Harmonious—Abrupt Abundant—Monotonous
Brightness	Bright—Obscure
Composition	Balanced—Imbalanced Emphasize the key content—De-emphasize the key content
Character depiction	Ingenious—Rigid Exquisite—Crude Bold—Feeble Stereotype Heterogeneity—Stereotype Vivid—Formalistic Rounded—Incisive Ethereal—Ponderous
Theme	Elegant—Worldly Alive—Depressed Cloistered—Non-cloistered Urge virtue and goodwill—Self-indulgent Blessed—Imprecatory Indomitable—Drift with the current Exhortation to Focus—Abandon oneself to idle Modest and Unassuming—It's lonely at the top Beautiful—Ugly Festive—Desolate Joyful—Dull Jubilant—Bleak

not only an expression of art but also a symbol of culture, history, and identity; (2) Murals can be used as a tool for community development, identity, and cultural heritage education; (3) Murals contribute to public awareness of environmental sustainability, cultural awareness, and a sense of community belonging; (4) The creation and presence of Murals fosters communication and unity in the community. Overall, these studies collectively reveal the centrality of Murals in community building, cultural heritage preservation, and social exchange, emphasizing their combined value in the dimensions of education, Familiarity, and Sociability.

In addition to the granting of knowledge, modern art education focuses on the transmission of cultural values [83]. In the digital age, traditional art forms are at risk of being marginalized as they appear weak in comparison with the attractiveness of modern technology and media [84]. How to balance globalization and localization to ensure that cultural diversity and uniqueness are preserved deserves in-depth exploration. As a visual medium, the existence and continuity of mural art transcends time and space, conveying the message or values of a particular era. Therefore, murals are not only art; they also carry the memory of history, culture, and

society. When traditional elements in murals are gradually lost or diluted, the culture and values they represent suffer [85]. This phenomenon is caused by society's excessive pursuit of instant gratification and fast culture, which in turn tends to overlook deep and enduring cultural values [86], and may ultimately weaken the sense of social identity and affect the stability of the society [87]. According to Sakip et al. [88] art murals are suitable for use in urban backstreets and alleys because they can attract people to use these spaces, create natural surveillance reduce opportunities for criminal activity, and contribute to social cohesion. Art and education are not mutually exclusive. On the contrary, they can complement each other and together contribute to social and cultural development [89]. To this end, we need to revisit the goals and methods of arts education to ensure that they are aligned with the needs and challenges of contemporary society, as emphasized in the study by Ferrer et al. [90].

At the level of theoretical contributions, Vigerland and Borg [91] discuss how cultural capital shapes and influences consumer perceptions in commodity art forms by introducing the theory of "cultural capital", while this paper specifically focuses on the correlation between

Table 8 Calculation of evaluation indicators

Mural types	Evaluation dimensions	Image1	Image2	Image3	Image4	Image.....	Average Score
Historical allusion	Color Scheme	3.111	3.037	3.049	3.165	.....	3.084
	Brightness	2.889	3.012	3.111	3.224	.....	3.094
	Composition	3.889	3.802	3.790	3.657	.....	3.754
	Character depiction	3.000	2.790	2.901	2.989	.....	2.932
	Theme	3.556	3.543	3.383	3.443	.....	3.460
Legendary story	Color Scheme	4.333	3.111	4.667	4.222	.....	4.133
	Brightness	4.333	3.111	3.889	4.111	.....	3.756
	Composition	3.444	4.778	4.333	3.222	.....	3.867
	Character depiction	3.556	4.333	4.000	3.667	.....	3.756
	Theme	4.111	3.889	4.333	3.222	.....	3.978
Aspiring life	Color Scheme	4.333	3.889	3.778	4.000	.....	3.889
	Brightness	4.333	4.000	3.333	3.333	.....	3.644
	Composition	3.444	3.778	3.222	3.667	.....	3.578
	Character depiction	3.556	3.778	3.667	3.667	.....	3.778
	Theme	4.111	3.778	4.222	4.222	.....	4.044
Auspicious parable	Color Scheme	4.222	3.889	3.889	3.444	.....	3.844
	Brightness	3.444	3.667	3.444	3.667	.....	3.444
	Composition	3.889	3.667	3.222	3.667	.....	3.600
	Character depiction	3.889	4.111	3.889	3.444	.....	3.756
	Theme	3.889	4.222	3.889	3.667	.....	3.978
Celebrity story	Color Scheme	3.667	3.667	3.889	4.222	3.667	3.822
	Brightness	3.000	3.222	3.667	3.111	3.222	3.244
	Composition	4.333	4.222	4.444	3.333	4.111	4.089
	Character depiction	3.778	3.667	4.111	3.667	3.111	3.667
	Theme	3.444	3.333	4.333	4.111	3.667	3.778

economic costs and the dynamic characteristics of mural figures, revealing the diverse socio-economic manifestations of art commodities. By including the social structure and cultural production of a society as the object of study, Suleyeva et al. [92] analyze how rock mural art is constructed and transmitted across the boundaries of time and space from a sociological dimension. In contrast, Prasiasa [93] argues that the traditional experience of art, the perception of value, is crucial for place-making and cultural enrichment. He introduces the concept of “social interaction” to the theory of the public sphere and discusses how mural art communicates with the public and dialogues with modern society from a hermeneutical perspective. This paper provides a unique perspective on this form of artistic communication by specifying this dialog of the times in terms of statistical information on the number of female murals and the dynamic poses of the figures. In the interpretive-historical research dimension, Tansem [94] argues that religious artistic heritage is not only a reproduction of the past but also a critical reading and reflection on historical and cultural traditions, providing a bridge to assess and understand the past and the present. The finding that the color

representation of mural figures in the Ming and Qing dynasties differs significantly from folk color systems challenges traditional perceptions and provides empirical support for the practical application of Tansem’s critical framework. In the field of design, the study of traditional artifacts is often centered on the interaction between form and content of the “object” [95], while in the field of phenomenology, the study of tangible heritage often rises to the level of visual language and abstract social meaning [96]. In the field of semiotics, the cultural formative factors behind man-made artifacts are often in focus [97]. Ingram [98] extends the exploration of the formation, emergence, and transformation of traditional art to include a geopolitical dimension, arguing that the origin and form of artworks are the result of a confluence of factors. This paper returns to the exploration of the roots that influence the form of an artwork to its material heritage itself, expanding on the shaping and influence of clan ideology on the art of ancestral hall murals. At the same time, with the help of the KH Coder, this paper provides a concrete path for the application of text mining to art research.

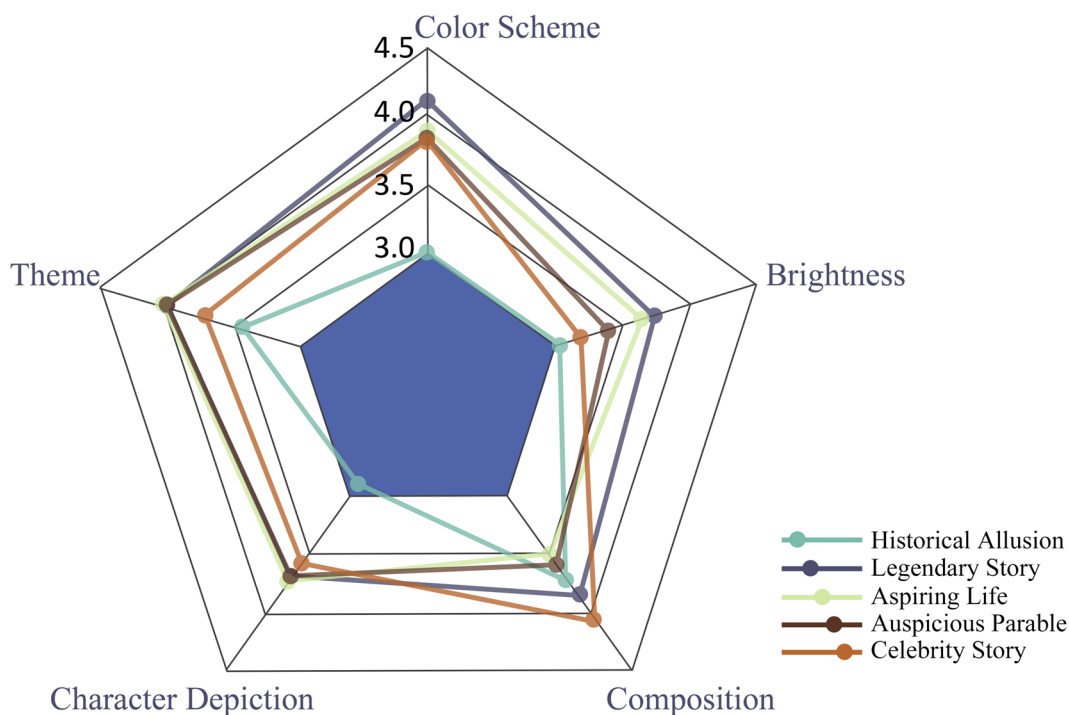


Fig. 6 Radar chart of average score for figure mural evaluation metrics

In the method realization path, Berkes et al. [99] presented the notion of “socio-ecological resilience”, which combines the connection between human and social environment as a concept of cultural values to address the process of cultural restoration. By merging the human landscape of locations into the notion of cultural restoration from a historical viewpoint, Zedler and Stevens [100] established the concept of “feeling of place” to examine the variations in cultural restoration orientation between China and the West. Abbasi et al.’s [101] idea of “memory of place” seeks to expand cultural education to the spirit of place to address the purpose of cultural restoration. To offer the meaning of cultural restoration in the modern period, Lapsley [102] introduced the notion of “personality development,” which includes the truth, goodness, and beauty of human nature and the proper values of the subject into the purpose of cultural restoration. Lucas’s [103] notion of “spiritual empowerment” seeks to instill the importance of storytelling throughout the cultural restoration process. This study explores the feasibility of aesthetic education in environmental art through artistic means, revealing the new-age significance of cultural restoration. The research on the influencing factors of rituals is significant because it has the potential to provide new ideas for the transmission of implicit values in cultural attributes. This study throws

light on the realization of passing on the excellent cultural genes in traditional rituals.

Figure 7 shows the academic contribution of this study in the field. In terms of theoretical and subject area contributions (Fig. 7a), Scholars in the field of art have developed different research foci around the topic of “tangible heritage culture and art”: (1) for artistry, artists are often concerned with the aesthetic value of their work, their technique and the evolution of their style; (2) for functionality, practicality, innovation and human–computer interaction are universal topics explored by design scholars; (3) for culture, anthropologists, historians, and cultural scientists tend to be more concerned with the restoration, preservation, and transmission of cultural heritages and how they reflect regional, cultural, and national specificities. In terms of methodology and realization path contributions (Fig. 7b), The current research constitutes three different dimensions, and has undergone a thematic expansion from “form and content” → “symbolic elements” → “cultural phenomena”, extending the depth to the level of social meaning. Material artistic expression was an early scholarly concern, with Bell-Villada [104], Gathercole [105], and Welch [106] focusing on the materiality and formal beauty of the artwork. Due to the diversity of the arts and the complexity of the mechanisms of material shaping, this element is then

Table 9 Functional properties study of ancestral hall murals

Functions	Year	Authors	Findings
Educationality	2014	Ho [66]	As a curriculum in the non-conventional education system, murals set the tone for public art education in the Brunei community and unite the community to create a proud cultural heritage for its members
	2014	Schneller and Irizarry [67]	Although there is no direct evidence of whether the impacts of sea turtle murals in California have reduced the frequency of gear used by local fishermen, community murals have increased public environmental awareness and behavior
	2018	Morales and Barnes [68]	The city itself becomes a critical area for learning and engaging with the concept of thresholds in Religious Studies, and the Baltimore Mural Project (BMP) can help students overcome barriers to learning in Religious Studies by giving them a better understanding of the core concepts of religion
	2020	Soto-Martin et al. [69]	The DStretch® tool allows for in-depth analysis and visualization of murals, helping to increase students' sense of responsibility for cultural heritage preservation, and authors promote the reinforcement of this educational aspect through the creation of mural art
	2020	de-Miguel-Molina [70]	Constructing a common narrative to appeal to different stakeholders is a great way to attract people interested in educational and historical issues, such as the Cable Street Battle Mural in London. Dark murals alone have the potential to attract visitors in an economically and culturally sustainable way
	2020	De Miguel Molina et al. [71]	The mural movement has been shown to create positive effects on community development and identity preservation. Public mural art allows citizens to experience shared history and identity, and visitors to learn about local ethnic history
Familiality	2013	Debs [72]	The author emphasizes the cultural importance of the broken frescoes of St. Francis Cathedral. Based on the theory of cultural trauma, the reconstruction of the cathedral and Giotto's frescoes is seen as a miracle and symbol of national and ethnic unity
	2014	Heidenry [73]	In El Salvador, the painting of community murals has become a tool of left-wing political propaganda used to reclaim local identities, subvert contemporary struggles, and exert political power. Mural painting in El Salvador reveals efforts to construct a shared culture
	2016	Fujikawa [74]	The artwork has political overtones. The frescoes at Quirinal are enduring evidence of Pope Paul V's diplomatic initiatives, reflecting the pope's ambitions to establish a pan-continental military and commercial network to counter the Ottoman Empire and Protestants
	2016	Chakravarty and Hwee-Hwa Chan [75]	Murals in the Los Angeles area have played an important role in creating a sense of belonging and mitigating racial tensions. Understanding the evolving function and multifaceted potential of murals is critical to sense-of-place making, identity strengthening, and community planning
	2017	Tamaira [76]	Based on spatial-political and ideological theories, the author argues that architectural murals can be used as a medium for cultural sustainability and urban management and that they can raise the political consciousness of the nation through material and symbolic means
	2019	Malott [77]	Mexico's murals reflect community resistance and expression, mirroring a critique of the dominant culture. It is important to understand this complex cultural phenomenon and the motivations behind it, which symbolize Mexico's historical, cultural, and political identity
Sociability	2012	Rossetto [78]	Mural creation is a form of behavioral therapy. By bringing communities together, it can facilitate community exchange and the creation of cultural values
	2018	Graham and Fabricius [79]	Mural creation has benefits in a variety of ways, including sustained attention, aesthetic awareness, memory, identity, and social communication among residents. Users' communication is enhanced by the interaction of the act of creation
	2020	Park et al. [80]	Historical murals with local characters can promote the heritage economy and activate the flow of visitors to tourist sites, thus creating centrality in small regions

Table 9 (continued)

Functions	Year	Authors	Findings
	2021	Martínez-Carazo et al. [81]	Mural spaces in Uruguay are beginning to decentralize and become fragile as a result of tourism and the heritage economy. Historical murals help to promote direct dialogue between different community stakeholders to achieve environmental balance and sustainable management
	2021	Mendelson-Shwartz and Mendelson-Shwartz [82]	Evaluating mural policies can lead to a better understanding of how our cities are shaped and managed, who has the power to modify public spaces, and how different interests and stakeholders are considered and prioritized

expanded into the fields of semiotics [107], sociology [108], and phenomenology [108, 109]. Carrabine [110], for example, explores how the turn of narrative in criminology can help explain fresco images, arguing that images of extreme violence do not fully reflect the reality of medieval life. Recently, the term “material culture” has been emphasized, and some scholars, such as Zubieta [111], Douglass and Badham [112], and Arroyo-Lemus [109], have argued that works of art are not only the product of aesthetic needs, but also the result of multiculturalism and artisanal skills. At the same time, Chicoine [113] returns to the origins of visual symbols and their decorative elements and builds bridges between art, design, semiotics, and phenomenology, emphasizing the social nature of the tangible heritage itself, and arguing that the study of traditional art should not only focus on the form and technique, but also delve deeper into the cultural and historical

connotations behind it. Based on the text-mining technology of computer algorithms, this paper analyzes the text of the mural paintings of ancestral halls with the help of the KH Coder tool and carries out multidisciplinary research that integrates art, design, phenomenology, and semiotics. Compared with traditional single-disciplinary perspectives and research methods, this paper employs information technology tools to provide a wide range of perspectives, frameworks, and examples from the perspective of cultural and ritual criticism, and to ponder how to integrate art and technology to perpetuate and pass on the excellent genes in traditional art. The integration of art and information technology will bring opportunities to traditional art research, as exemplified by Kouretsis et al. [114], Xie [115] and Liu et al. [116], and others. This paper promotes interdisciplinarity in the arts.

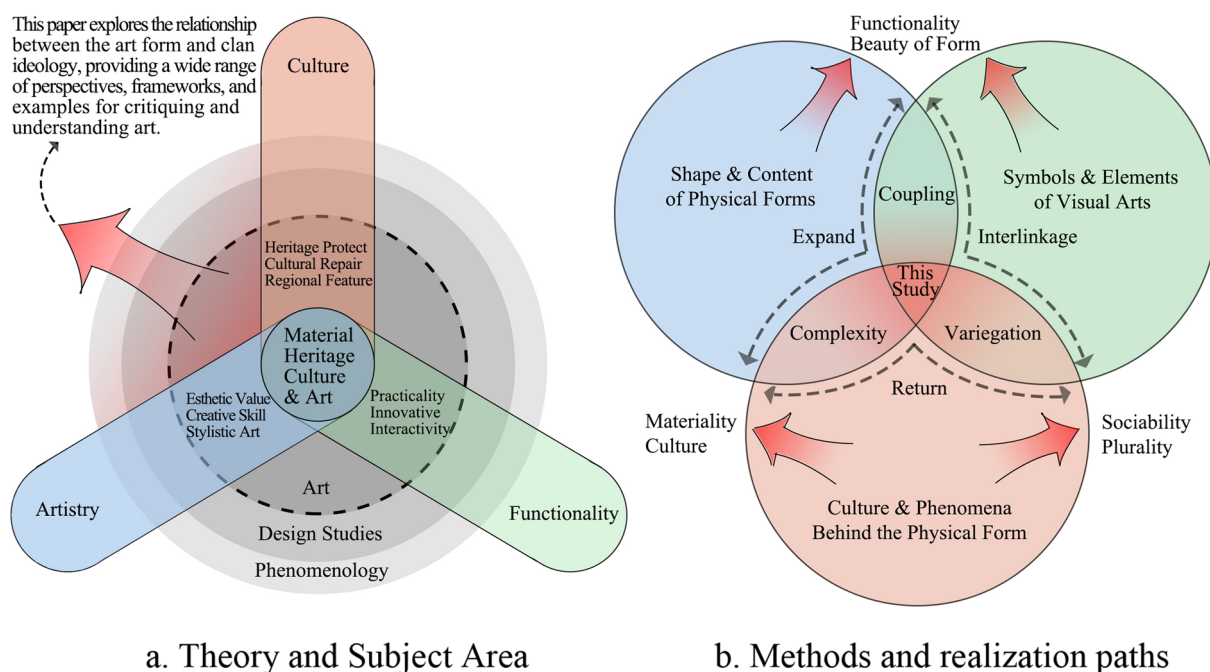


Fig. 7 Academic contribution map

Sippola et al. [117] state that the essence of historical research is to reveal the cultural capital and power relations in the social structure. Stainforth [118] argues that traditional art research is to tap into the collective memory and identity of society. In the sociological dimension, Hallström [119], on the other hand, states that the past is studied to understand the cohesion and structure of modern societies to predict and guide future social change and development. This study draws out the relevant factors affecting the decorative art of murals, explores how traditional patriarchal rituals influence the values of decorative art, and reveals the intertwined relationship between power, identity, and culture in artistic expression, and how to perpetuate the good genes therein in modern society. From the perspective of cultural hermeneutics, the culture and values embedded in the murals themselves have a potential role in promoting social progress [120]. In the context of globalization, the question of how to balance tradition and modernity and preserve cultural diversity and uniqueness has become an urgent one. In terms of ritual education, the revelation of the value of mural art in ancestral halls has a potential motivational mechanism for social promotion and provides a new perspective on artistic empowerment.

The coverage aspect of the mural paintings taken limits the scope of this work. The majority of the paintings (51.6%), 269, were done in the ancestral hall entryway, while the remainder were decorated in the chancel, rear hall, and other sections. Mural content is frequently connected to the location and spatial purpose of their decorating, and a non-equal fraction of sample coverage may lead to partial bias in the study results. To ensure the scientific validity and objectivity of further in-depth research, the researcher should improve in the following areas: (1) authors should select representative samples in a balanced manner, paying attention to the relationship between the location of the mural and its pictorial content to ensure that all parts of the ancestral halls are adequately considered; (2) Consider introducing multivariate data analysis to more fully assess the impact of the cultural, historical, and social context of murals on their content and form; (3) Conduct cross-cultural or cross-regional comparative studies to reveal common features and differences of murals in different cultural and geographical contexts.

Conclusion

The study process showed that: (1) The 521 frescoes' tale themes and allegorical interpretations mainly offer positive content, and the paintings' characters, objects, flowers, and other ornamental art references express the

idealistic goal of both material life and spiritual excellence; (2) The change from formal to relaxed sitting and grooming of the figures in the Guangdong ancestral hall murals reflects, to a certain extent, the dilution of the idea of patriarchal propriety; (3) The influence of economic costs may be a possible explanation for the proliferation of figures in crouching, skirting, and side-lying postures in Guangdong ancestral hall murals; (4) The color expression of fresco figures in the Ming and Qing dynasties did not fit to the folk color system, indicating that artistic creativity at the period was not overly constrained by patriarchal traditions; (5) The growth in the number of female paintings indicates that throughout the age of "male supremacy over women," the human rights and value of women began to be highlighted.

According to the study, the rounded representation of the characters in the paintings linked the ornamental art of Guangdong ancestral hall murals with a back-to-human quality, asserting the value and dignity of human beings even more. To some extent, the representation and coloring of the characters in the murals is a focused reflection of ancient rites and ethical ideas.

The conclusions in sub Sect. "The evolution of sitting and lying reflected in the figure's form and rhyme - reflecting the dynamic change of etiquette from respectful to natural" are based on the interpretation of quantitative statistics on the size of the frescoes and the poses of the figures in the paintings and may be somewhat subjective. Due to the limitations of objective reasons, this paper was unable to find directly relevant evidence to support the correlation between economic cost control and the dynamics of frescoed figures. Nevertheless, the findings of this paper still provide new perspectives and aspects of reflection on this crucial aspect. The team will explore this aspect in depth in the future.

Supplementary Information

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Additional file 1. Mural classification and descriptive information.

Author contributions

Conceptualization, WL, HL and YL; methodology, WL, HL and WS; software, WL, SC and WS; validation, WL, HL and YL; formal analysis, WL, SC and YL; investigation, WL, HL and SC; resources, YL and SC; data curation, WL, HL and YL; writing—original draft preparation, WL and HL; writing—review and editing, WL, HL and YL; visualization, WL and SC; supervision, WL and YL; project administration, WL, YL and HL; funding acquisition, HL and YL. All authors have read and agreed to the published version of the manuscript.

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Data availability

Original mural data (Excel) on the textual analysis has been submitted as Additional file 1. Some or all data, models, or code generated or used during the study are available from the corresponding author by request.

Declarations

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Not applicable

Consent for publication

Not applicable.

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