Spatial characteristics of defensive traditional architecture in multiethnic village of Guangxi: Case studies of Mozhuang Village and Guxietun Village

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Abstract

Defensive traditional architecture research is critical to the understanding of the ethnic history and multiethnic villages. Currently, there are few studies on the combination of traditional architecture and multiethnicity, and most of the defensive traditional buildings in multiethnic villages of Guangxi are facing the plight of being destroyed and abandoned. The aim of this research is to identify the spatial characteristics, commonalities, and differences of Guangxi’s defensive traditional architecture with Mozhuang Village and Guxietun Village as the examples, in order to preserve the architectural and ethnic components of these villages. This research uses the four research methods: literature review, field research, observation and space syntax analysis, and it summarizes the three results from the five aspects: plan, elevation, construction material, masonry and decoration. Results showed that the spatial characteristics are dominated by the ethnic group with the higher technological, cultural or economic level, and there are both commonalities and differences in defensive traditional architecture in multiethnic villages. Based on the three study results, this research proposes some overall suggestions toward traditional villages and architecture improvement in ethnic areas.

1. Introduction

In recent years, numerous villages have been actively implementing village conservation and reconstruction programs as an effective method of enhancing the ethnic cultural industries (Cillis et al., 2019; Dasic et al., 2020;
2. Literature review

An extensive literature review was conducted as follows: first, a narrative review on Chinese defensive traditional architecture in China is performed to explore the research trend, followed by a systematic review related to the multiethnic background of Guangxi. Last, a review on defensive traditional architecture in the multiethnic village of Guangxi. This process was performed to understand the research reasons and the gap in research.

2.1. Studies on Chinese defensive traditional architecture

Defensive traditional architecture has long been a topic of profound research interest in the fields of architectural design, township planning and cultural heritage, and specific achievements have been completed in researching Chinese defensive architecture. According, to the relevant literatures for the last five years retrieved from Google Scholar, previous studies are presented as follows.

Defensive traditional architecture exists in almost every province due to China’s long war history and vast territory (Shen et al., 2020; Xiang et al., 2018). The current studies show that the most frequent provinces that are studied in the research literature on defensive traditional architecture are Fujian Province (11 articles) (Colafranceschi et al., 2020; Conte et al., 2020; Frangedaki et al., 2020; Hua et al., 2018; Huang, 2019; Li et al., 2020; Porretta et al., 2022; Qin et al., 2022; Xie et al., 2022; Xue et al., 2021d; Zhou, 2021) and Guangdong Province (10 articles) (Chao and Yaping, 2018; Ficarelli and Vaccia, 2020; Pan et al., 2020; Tao et al., 2021; Xue et al., 2021a, 2021b, 2021c; Yin et al., 2019; Zhang et al., 2018a,b). Enclosed houses (围屋), Tulou (土楼), Tunpu settlement (屯堡), turret, and blockhouses in the two provinces were systematically studied as defensive traditional architecture. Defensive traditional architecture is considered a significant part of the international built heritage, or “spirit of place” (Yazdani Mehr and Wilkinson, 2020), and new building techniques and design methods must be used to protect defensive traditional architecture (Colafranceschi et al., 2020; Frangedaki et al., 2020; He et al., 2021; Li et al., 2020; Porretta et al., 2022; Shao et al., 2022; Shu and He, 2021). Positive and relevant relationships between specific types of traditional villages and specific types of culture have also been recognized by relevant scholars (Huang et al., 2022; Xue et al., 2021b). Defensive village spatial morphology needs to be supplemented and revised with quantitative analysis, namely, the combination of space image and quantitative analysis (Nancarrow et al., 2021; Nguyen et al., 2019; Xue et al., 2021c; D. Zhang et al., 2022), this view was endorsed by some scholars and was studied in a more expanded scope (Ge et al., 2022; Pan et al., 2020; X. Wei, 2019; Xie et al., 2022). Traditional architecture is evidence of cultural and historical information that can be studied in four aspects: regional environment, traditional layout, architecture characteristics, and historical environment. This affirms the value of traditional village studies for cultural traditions (Ding and Zhang, 2023; Wei and Zhou, 2021; Yan et al., 2020). In contrast, there are very few studies related to defensive traditional architecture in Guangxi, which does not match the status quo regarding the history of ethnic migration and the numerous ethnic villages in Guangxi. Some local
researchers in Guangxi have taken the initiative to immediately preserve and protect defensive traditional architecture that is facing a great crisis (Deng and He, 2022; Feng and Tang, 2021; Huang, 2020; Ji, 2020; Wang et al., 2021; Wei, 2019; Zhang et al., 2022).

2.2. Studies on the multiethnic background of Guangxi

Multiethnicity is an important social background and attraction in Guangxi (Wong et al., 2019). From the Spring and Autumn Period (春秋时期, 770—476 B.C.), a definite ethnic culture was recorded in Guangxi (Fu and Qin, 2010; Lin et al., 2022). During the long historical development, various ethnic groups have formed an important part of the traditional Guangxi culture with their unique cultures.

In several important Chinese official conferences, the current situation of multiethnicity in Guangxi has received attention many times (Chen, 2020; Li and Liu, 2021), and it has been suggested repeatedly that scholars should grasp this multiethnic feature for research. Numerous researchers have agreed and responded successively with relevant results (Gao, 2021; Li and Yuan, 2020; Wang, 2021; Zeng and Li, 2022). Therefore, the multiethnic background is fundamental to the stability and development of Guangxi, and is also a hot topic for related research in the near future.

2.3. Overview of defensive traditional architecture in multiethnic village of Guangxi

Traditional architecture is an intuitive and lifelike approach to the expression and development of multiethnic culture of Guangxi (Lu et al., 2019), and it records the development of various ethnic groups over thousands of years from a spatial aspect (Punter, 2019).

First, the number of studies on traditional architecture and traditional villages in Guangxi is among the highest in China (Wen, 2021; Xie, 2021). However, the study of defensive traditional architecture in Guangxi is relatively rare and not actively known and inherited by the population. Compared to Fujian and Guangdong, the two Chinese provinces with the most relevant research, Guangxi has a similar historical, geographic, and ethnic composition, but without matching research outcomes. Thus, the deficiency of research of Guangxi’s defensive traditional architecture deserves attention.

Second, previous studies were focused on perspectives of Chinese defensive traditional architecture, involving the villages and multiethnic background of Guangxi. Both areas have attracted researchers’ attention, but few explorations have been made on the combination of defensive traditional architecture and multiethnicity. Analyzing the spatial characteristics of defensive traditional architecture in multiethnic villages should be actionable complementary research to cope with the dilemma of defensive traditional architecture.

Therefore, this research makes up for the deficiency of related studies in the same field in Guangxi, adds spatial syntax method while the qualitative analysis, and systematically analyzes the defensive traditional architecture in terms of traditional layout and architectural characteristics, namely, plan, elevation, construction material, masonry and decoration.

3. Research methods

3.1. Selection of the research sites

In this study, Mozhuang Village and Guxietun Village were selected as representatives of multiethnic villages. Mozhuang Village is located in Shanglin County, Nanning City, central Guangxi while Guxietun Village is located in Liucheng County, Liuzhou City, northern Guangxi. Two villages were selected, not only because the ethnic groups of the two villages are among the major ethnic groups in Guangxi but also, the two villages are included in the National Ethnic Villages Catalog and Provincial Protected Historic Sites, which gives them officially certified representation. The ethnic groups, built period, location, economic strength and climate of the two villages are shown in Table 1 (Bureau L.C.S., 2022; Bureau S.C.S., 2022; Committee, 1989, 2009; Editorial Committee, 1992; Mo, 2003).

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Mozhuang Village</th>
<th>Guxietun Village</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnic groups</td>
<td>Zhuang</td>
<td>Mulam (Mulao, 仫佬族)</td>
</tr>
<tr>
<td></td>
<td>Han Chinese</td>
<td>Han Chinese</td>
</tr>
<tr>
<td>Building time</td>
<td>Early 18th century</td>
<td>Late 14th century</td>
</tr>
<tr>
<td>Location</td>
<td>Central plains</td>
<td>North mountains</td>
</tr>
<tr>
<td>Economic strength</td>
<td>Relatively strong</td>
<td>Relatively weak</td>
</tr>
<tr>
<td>Climate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual average temperature (°C)</td>
<td>21.1</td>
<td>20.2</td>
</tr>
<tr>
<td>Elevation (m)</td>
<td>Approximately 120</td>
<td>Approximately 281</td>
</tr>
<tr>
<td>Annual average rainfall (mm)</td>
<td>1789.2</td>
<td>1100—2800</td>
</tr>
</tbody>
</table>

The research was conducted on four selection criteria to ensure the reasonableness of the six research sites: preservation integrity, building size, construction age, and the existing defensive space. Six defensive traditional buildings were selected as research sites (Table 2) through map analysis, field research, interviews with villagers, and local genealogy. The six research sites are: Mo’s Ancestral Hall
(磨氏祖堂), Liang’s Ancestral Hall (梁氏宗祠), Liang’s Ancestral House (梁氏祖屋), Jinshi’s Ancestral House (进士祖屋), and Gate House (门楼), Gate House Shuo Fang Shou Shan (hereafter referred to as Gate House SFSS. 朔方首善门楼) (Fig. 1). The six research sites are the well-preserved, larger buildings in the village, all of which were built during the war period and are the most representative of defensive traditional buildings in the village. Historically, Guangxi society was turbulent and bandits roamed the countryside. To counter this security threat, six research sites were constructed with systematic and specific spatial designs for defense, attack, escape and other defensive functions. Therefore, the six defensive traditional buildings were selected for the research sites which have fulfilled the criteria (Fig. 1).

The Han Chinese ancestors of both villages came from northern ancient China, migrated here to avoid war, lived with local proto-indigenous peoples and built villages and buildings together. Therefore, the ethnic composition and traditional architecture of Mozhuang Village and Guxietun

<table>
<thead>
<tr>
<th>No.</th>
<th>Architecture</th>
<th>Location</th>
<th>Completed period</th>
<th>Function</th>
<th>Daily period</th>
<th>Defense period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mo’s Ancestral Hall</td>
<td>Mozhuang Village</td>
<td>18th century</td>
<td>Worship, gathering Residence, meeting and training</td>
<td>Residence, meeting and training</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Jinshi’s Ancestral House</td>
<td>18th century</td>
<td>Residence</td>
<td>Residence and defense</td>
<td>Residence and defense</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Gate House</td>
<td>20th century</td>
<td>Transport</td>
<td>Interception and defense</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Liang’s Ancestral Hall</td>
<td>Guxietun Village</td>
<td>20th century</td>
<td>Worship, gathering Residence, meeting</td>
<td>Residence and meeting</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Liang’s Ancestral House</td>
<td>18th century</td>
<td>Residence</td>
<td>Residence and defense</td>
<td>Residence and defense</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Gate House (SFSS)</td>
<td>18th century</td>
<td>Transport, identification</td>
<td>Interception and defense</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1 Six defensive traditional buildings. (a) Mo’s Ancestral Hall; (b) Liang’s Ancestral Hall; (c) Jinshi’s Ancestral House; (d) Liang’s Ancestral House; (e) Gate House; (f) Gate House SFSS. Photo by authors.
Village match the scope of this research, and the spatial characteristics of their defensive traditional architecture deserve in-depth study.

3.2. Research methods

The research methods used in this study were based on a literature review, field research, qualitative analysis, and quantitative analysis. Additionally, because builders, maintainers, and conservators of the buildings are deceased or too old to provide accurate information, most of the valuable historical documentation was sought from the literature. The literature sourced for this study included academic papers, genealogies, county records, township records, media, and official websites.

First, basic data were collected from Google Map analysis, the local genealogical text, county and township records, and ethnic-related documents. Second, field investigations, architecture surveying and mapping, and semi-structured interviews with villagers were conducted to collect first-hand data from the six research sites. Third, qualitative analysis of these and other data revealed that differences and similarities in construction materials, masonry, and decorations existed within the six research sites. Fourth, quantitative analysis of plans and elevations presented related differences and similarities.

4. Analysis of spatial characteristics

4.1. Characteristics of plans and elevations

The following is a comparative analysis of the five aspects of the spatial characteristics of the six research sites: plan, elevation, construction material, masonry, and decoration.

4.1.1. Central axis of plans

The two ancestral halls and the two ancestral houses are located on different landforms; however, it appears that the landforms do not significantly affect the plans. The two ancestral halls consist of three halls, namely, front, middle and back halls. All halls were arranged in strict sequence along the central axis and separated from each other by a patio or square. Meanwhile, the spaces of the two ancestral houses also follow almost the same layout as the central axis. Jinshi’s Ancestral House is composed of four small courtyards, arranged in an east–west direction, surrounded by two rows of side rooms, tall walls and a turret, forming a complete close defensive space. This similar design is also presented in Liang’s Ancestral House. The plan of Liang’s Ancestral House appeared to be relatively simple; it is a small courtyard with a turret, and the hall, patio, bedrooms and back door were symmetrically arranged on the central axis. It is noteworthy that the area of the front door formed a right-angle turn with a shadow-wall (影壁) to avoid direct attack from the enemy (Fig. 2).

These plans and routes were the result of elaborate designs by the ancestors of the villagers, which served to stop enemy attacks and quickly evacuate villagers during many wars. The central axis plan reflects the decisiveness of the Han Chinese’s traditional order (Li and Peng, 2021; Xu, 2023) on the plans of these traditional buildings, even though they were located in remote provinces. The villagers recognize and familiarize themselves with this type of plan. These spaces can be used mutually and orderly on a daily basis.

During defense periods, the architecture could be reasonably divided into three types of isolated spaces, namely, dangerous space, passive defensive space, and active defensive space. In ordered, centrally symmetric spaces, villagers could rapidly recognize the three types of spaces, and attack or escape immediately. These spaces did not have durable resistance to attack because of the material shortcomings of the wooden partitions, so the design of escape routes was essential. Each building has back door(s) at the end of the escape route(s), which was (were) not easily identifiable by the enemy due to its location. Distributed back doors formed some alternative escape routes. Villagers could set obstacles for the enemies through hidden doors in the walls between the courtyards during the evacuation process (Fig. 3).

4.1.2. Spatial analysis based on space syntax

Space is considered to be a net of connections between different areas, and spatial syntax could be used to delineate spatial characters, as well as to objectively compare two spaces (Dettlaff, 2014). In this research, Jinshi’s Ancestral House and Liang’s Ancestral House were selected as the analysis sites for space syntax. Figs. 4–6 demonstrate the findings of spatial syntactical analysis based on isovist space and convex space.

In terms of visibility, the spaces with the highest visibility are the front main alley of Jinshi’s Ancestral House and the patio of Liang’s Ancestral House, while most of the remaining spaces have lower visibility. The visibility of Jinshi’s Ancestral House is more extreme while Liang’s Ancestral House is relatively balanced.

In terms integration, the integration of the internal spaces of the two ancestral houses is generally low. The highest integrations are located in the front main alley of Jinshi’s Ancestral House (1.633) and the patio of Liang’s Ancestral House (0.917), which indicates that these two spaces have a strong guiding force over the surrounding spaces. The integration of the back main alley of Jinshi’s Ancestral House (1.197) is followed by the front main alley, then by the halls of the four courtyards (0.830, 0.936, 1.012 and 0.904, respectively). This decreasing distribution of these spaces not only ensures diversity of the visual area, but also overlaps or parallels the central axis mentioned above, highlighting the importance of the core area, namely, the four courtyards. The integrations of the back doors and the turrets in the two ancestral houses are the lowest, and the topological distance between the turret and the front door is short, implying more direct attack and faster transfer speed.

In terms of choice, the choice of Jinshi’s Ancestral House is generally low, while Liang’s Ancestral House is relatively balanced. The highest values are in the front main alley of Jinshi’s Ancestral House (1.175) and the patio of Liang’s Ancestral House (1.278). At Jinshi’s Ancestral House, there is obvious discontinuity of the choice between the front main alley and other spaces, indicating that the front main alley has a weak connection with other spaces and the existence of spatial disorientation and concealment. The
The patios of the four courtyards keep similar degrees of choice to the back main alley, which represents a convenient way for the residents to escape. In contrast, the choice of the spaces of Liang's Ancestral House shows a trend of decreasing gradually, which means that it could be easily passed through.

4.1.3. Elevations of the gate houses

In contrast to the complex plan combinations of the two ancestral halls, the plans of the two gate houses are extremely simple and practical, but their elevations were more focused on defense.

In terms of Gate House in Mozhuang Village, it is located on the narrow village road in southwest corner within the village, next to the Jinshi’s Ancestral House. Its two opposite facades have small square windows. The upper floor is used on a daily basis as a home school for children; during war, the upper floor can be used by villagers for breaks, lookouts and shooting. A steep dirt stairway is on the gable wall of the upper level for villagers to access. The lower

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Fig. 2  Plans of the six research sites. (a) Mo’s Ancestral Hall; (b) Liang’s Ancestral Hall; (c) Liang’s Ancestral; (d) Jinshi’s Ancestral House. Source: authors.
level is an entrance on the village road and is fitted with two wooden gates (now lost) to intercept the enemy during wartime (Fig. 7).

In terms of Gate House (SFSS), its location on the outermost stone wall of the Guxietun Village, and is considered as the boundary of the village. This building consists of two levels, the upper level is a covered quadrangular room used for lookout and shooting, while the lower level is hollow and has access to the village through a wooden door (now lost). The walls of the upper floor were designed with narrow windows, narrow doorways and gun holes. There are natural stone steps outside the narrow doors on each side of the gable walls (Fig. 8).

Fig. 3 Different spaces during defense periods. (a) Mo’s Ancestral Hall; (b) Liang’s Ancestral Hall; (c) Liang’s Ancestral House; (d) Jinshi’s Ancestral House. Source: authors.

Fig. 4 Visibility graph analysis of Jinshi’s Ancestral House and Liang’s Ancestral House (Plan grid 1 m×1 m). Source: authors.

Fig. 5 Integration graph analysis of Jinshi’s Ancestral House and Liang’s Ancestral House (Plan grid 1 m×1 m). Source: authors.
4.1.4. Shooting range of the two turrets

An uncommon defensive space, the turret, is located in the southeast corner of Jinshi’s Ancestral House and the southwest corner of Liang’s Ancestral Houses. The turrets are the tallest structures in the two ancestral houses, and shooting windows or shooting holes are oriented in different directions of the walls of the turrets.

**Turret in Jinshi’s Ancestral House:** The turret presents a rectangular plan with a total height of 7.85 m. There are three floors with heights varying from 2.5 to 3.5 m. The turret has three floors with heights ranging from 2.5 to 3.5 m, with one shooting window and two shooting holes. The turret faces the gate of the first courtyard and its shooting range covers the front main alley, the patio and the second gate of the first courtyard, which ensures the safety of the southeast corner of Jinshi’s Ancestral House (Fig. 9).

**Turret in Liang’s Ancestral House:** The plan of the turret is rectangular, and the interior space is very narrow and low-ceilinged, only 2–3 people can stand. The total height of the turret is 9.9 m and is divided into four floors. The first to the third floor are interior rooms, and the fourth floor contains an open balcony. The walls of the turret are built with shooting windows (9) and shooting holes (7),

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![Choice graph analysis of Jinshi’s Ancestral House and Liang’s Ancestral House (Plan grid 1 m×1 m). Source: authors.](image)

![Fig. 7 Elevation of Gate House in Mozhuang Village. (a) Front elevation; (b) Side elevation. Source: authors.](image)

![Fig. 8 Elevation of Gate House (SFSS) in Guxietun Village. (a) Front elevation; (b) Side elevation; (c) Section; (d) Gate House (SFSS). Source: authors.](image)
covering the Ancestral House, village road and roofs of neighboring houses. It is located to the southwest of the Ancestral House and adjacent to the 1.6 m wide village road and a nearby Gatehouse, which is very similar to the compact layout of the village (Fig. 10).

4.2. Characteristics of construction materials

The construction materials are taken from the local natural environment. Mozhuang Village is on a plain with abundant rainfall, a warm climate, fertile land and rich forest resources. In contrast, Guxietun Village is located in a mountainous area rich in stone resources but lacking in forest, with wide variations in rainfall and climate and relatively low temperatures. Thus, local stones are adapted to this changeable climate and harsh natural environment. The analysis regarding the characteristics of construction materials is elaborated in Fig. 11.3,4

3 Dark tile (also known as Gray tile, Black tile. 青瓦): Dark tile is made of clay as main material for firing. Typically, the thicker the dark tile, the more solid it is, and the more clay it consumes.

4 Blue brick (青砖): Blue brick is made of clay fired at high temperatures. It is one of the traditional Chinese crafts. Typically, the harder the texture of blue brick, the higher the quality, and the more clay is consumed.
Fig. 11  Illustration of construction materials of the six research sites. Photo by authors.
From Fig. 11, a comparative illustration of the roofs, walls and grounds of the six research sites revealed the following.

1) Dark tile and blue brick were the most commonly used construction materials at the six research sites, and the quality of the dark tile and blue brick in Mozhuang Village was better than that in Guxietun Village.
2) In Mozhuang Village, brick and wooden construction materials were commonly used, while stone construction materials were more popular and abundant in Guxietun Village.
3) Stone construction materials are well preserved, bricks are relatively well preserved, but rammed loess and wooden materials are badly damaged.

4.3. Characteristics of masonry

As shown in the previous analysis, brick and dark tile were the main construction materials in the two villages. Given that tile installation in both villages is similar and simple, this section focuses on brick masonry. The techniques of brick making and bricklaying were brought to the local area by Han Chinese from the north and rapidly became one of the major building materials because of its excellent physical properties (Almssad et al., 2022; Xiao et al., 2021).

Although the exact timing of the appearance of the brick in the villages is unclear, the production process of brick was partially standardized during the period of the Republic of China (1912–1949) (Mo, 2003). As illustrated in Fig. 12, the villagers in Mozhuang Village were good at making bricks, and this advantage led to more sophisticated brickmaking and bricklaying processes. In contrast, a simple combination of brick and stone was more common in Guxietun Village.

Obvious differences are present in the masonry of the six research sites. The bricks from the three research sites in Mozhuang Village are smaller and thinner, and are double stacked in parallel with approximately 8 mm thick mortar. These may be related to the excellent brickmaking techniques and the demanding heat dissipation requirements.
The bricks at the wall base are in direct contact with the ground with shallow or no drains next to them, which may be related to the lack of rain and snow in the area. Parts of the walls with shooting holes and shooting windows were completely hollowed out (Fig. 13).

In contrast, in Guxietun Village, local stones were used more frequently. The bricks are usually larger and thicker in the walls because of heavy rain and snow, lower levels of brick making, and a stronger need for defense. The two rows of bricks were filled with clay, which provided insulation and added thickness and were stacked in parallel and vertical staggers. Meanwhile, strip stones and rubber stones were used as the wall base to enhance the building’s solidity and resistance to snow and rain. Deep drains beside the wall bases were used to divert rain, snow and stream water from the back hill; in war time, the drains were used to channel stream water into the buildings for survival of the villagers (Fig. 14).

4.4. Characteristics of decoration

Decoration is the focus of aesthetic expression and an inseparable part of the architectural space (Yang and Feng, 2020). Among these decorations, it is common that they are influenced by traditional Han Chinese culture and present Han-style decorations that are widely known. The difference is that there were types of decorations in Mozhuang Village and they were more elaborate (Fig. 15).

5. Discussion

The research analysis is undoubtedly groundbreaking for a multiethnic region such as Guangxi and can provide a reference for an extensive understanding of traditional architecture. Considering the factors of ethnic migration history, economic strength and the natural environment of Mozhuang Village and Guxietun Village, we discuss three major points as follows.

First, regarding the spatial characteristics: 1) The six research sites showcased spatial characteristics dominated by the Han Chinese’s traditional order, including the central axis plan and the courtyard pattern. Although there were at least two different ethnic groups in the multiethnic villages, architectural construction was often dominated by the one with the higher technologica, cultural, or economic level, not necessarily by the most populous or indigenous ethnic group. Specifically, these buildings were constructed over several decades or even centuries, with the Han Chinese who migrated from the north gradually dominated the construction through their better construction techniques, higher cultural knowledge, or faster economic development. Consequently, these buildings typically presented the Han Chinese’s spatial order, with a little regard for defensive function. Instead, the ancestors of the villager usually fulfilled the defensive needs by other building elements. 2) The four research sites (Mo’s Ancestral Hall, Liang’s Ancestral Hall, Jinhui’s Ancestral House, and Liang’s Ancestral House) in the two villages had relatively complete decorations in their roof ridge, beam frame, pillar, and window. These diverse decorations indicated that the defensive spatial design had been successful, as the villagers, having acquired long-term physical security, could focus more attention on architectural decorations. Furthermore, the decorations were influenced by the Han Chinese culture, and the decorative patterns primarily featured birds, flowers, paintings, calligraphy, and auspicious patterns commonly used by the Han Chinese. These decorative patterns were also associated with spiritual defense.

Fig. 14  Section of the shooting hole in Liang’s Ancestral House. Source: authors.

5 Bogu (博古纹): Bogu refers to a traditional Chinese decorative pattern. The original meaning refers to ancient artifacts, and now it means “elegance” and “holiness”.

6 Ruyi (如意): Ruyi refers to a traditional Chinese decorative pattern. It is in the shape of a heart, signifying the application of “peace and prosperity”.

7 Baotou Beam (抱头梁): Baotou Beam refers to the short beam among the eave pillars and the king pillars. It is one of the important forms of wood framing in ancient Han Chinese architecture.

8 Chitou (墀头): Chitou refers to an ancient Chinese traditional building component, located between the gable walls and the eave pillars, to support the eaves. Typically, decorative patterns were used in the middle of Chitou.

9 Fu (福): Fu refers to a traditional Chinese decorative pattern. The Chinese character for “Fu” is used as a motif to express good luck and fortune.
Fig. 15  The decorations of the buildings. Photo by authors.
Second, regarding the commonalities: the spatial order of dominant ethnic group, plan arrangement and material source were important reasons for the commonalities of defensive traditional architecture, and these commonalities could be divided into three aspects: 1) The commonality determined by the spatial order of dominant ethnic group. In the two multiethnic villages in this research, the Han Chinese was the dominant ethnic group. They led the construction of the defensive buildings with a central axis plan and courtyard-style layout. Specifically, the central axis connected the main rooms in the core area of architecture, and the overall plan exhibited symmetry or relative balance. The one courtyard pattern consisted of one enclosed group of rooms, centered on one patio or square, with adjacent spaces having similar spatial attributes. 2) The commonality determined by the plan arrangement. In the four research sites (Mo’s Ancestral Hall, Liang’s Ancestral Hall, Jinshi’s Ancestral House, and Liang’s Ancestral House) had the three types of isolated spaces: dangerous space, passive defensive space and active defensive space. These three types of spaces were arranged in order from low to high defensive needs: front doors, alleys, patios and squares were within the dangerous space; public halls, public rooms and second gates were located in the passive defensive space; private rooms, hidden doors, back doors and turrets were placed in the active defensive space, where numerous defensive space designs were concentrated. 3) The commonality determined by the material source. The construction materials in all six research sites demonstrated a high degree of adaptation to the local natural environment. Due to low level of material production, the most durable and readily available natural substances were used as construction materials. In this study, because of the abundant soil and forest resources, brick and wooden construction materials were commonly used in villages on the plain, while stone construction materials were more popular in mountainous villages due to the abundance of local rocky hills and the lack of large trees. In addition, the widely use of dark tiles and bricks in both village buildings was evidence of the widespread acceptance of easily available and easily processed natural substances by the villagers.

Third, regarding the differences: the economic strengths, climates, and limitations of space were significant determinants of the differences in defensive traditional architecture in three aspects: 1) The difference determined by the economic strengths. Typically, the architecture and masonry in wealthier villages were generally more complex and sturdy, and the villagers were more actively upgrading building materials and decorations. In this study, the economic strength of Mozhuang Village was stronger than that of Guxietun Village. This could also be seen from the results of the spatial syntax analysis, which the degree of complexity and defensiveness of Jinshi’s Ancestral House of Mozhuang Village is significantly higher. Then, the three research sites in Mozhuang Village had a higher level of construction materials, with the more complex and sturdy masonry according to needs of defense, while the three research sites in Guxietun Village contained rougher construction material production and simpler masonry. Moreover, the decorations of Mo’s Ancestral Hall and Jinshi’s Ancestral House were not only diverse and larger in scales, but also more exquisite, with many cultural details, in contrast to the simple decorations or even no decorations of Liang’s Ancestral Hall and Liang’s Ancestral House. 2) The difference determined by the climates. The colder, harsher and more variable climate led to thicker building walls, brick-and-stone combination masonry, and deeper drains at the three research sites in Guxietun Village. On the other hand, the three research sites in Mozhuang Village, where the climate was stable and warm, had thinner building walls, diverse materials (such as wood, rammed loess and brick) and non-essential installation of drains. 3) The difference determined by the limitations of space. The influence of this aspect was particularly evident for small-scale defensive spaces, the gate houses and the turrets in this study. In terms of the gatehouses, Gate House of Mozhuang Village was near the center of the village, while Gate House SFSS of Guxietun Village was located at the boundary of village. Thus, Gate House SFSS was confronted with more limitations, including a wider counterattack range and shorter defensive distance. Thereby, Gate House SFSS was intentionally designed to be placed on the stone village wall, making it the tallest single structure at the time, and with double-sided walls of shooting windows and shooting holes. In contrast, the defense requirement of the Gate House of Mozhuang Village was relatively low, with two functions divided into wartime and daily. Then in terms of the turrets, both of which were located inside the residence, but differed in their plan scales, number of levels, overall heights, shooting ranges, and number of shooting windows and shooting holes. The intense defensive design of the turret of Liang’s Ancestral House, with its more levels, higher overall height, larger shooting range, and more shooting windows and holes, was related to the compact external spatial limitation. The constricted space forced the turret scale to be reduced, and this could only be compensated for by increasing overall height, expanding shooting range, and adding more shooting windows and holes.

In summary, the spatial characteristics of defensive traditional architecture in multi-ethnic villages of Guangxi were reflected under the traditional order of dominant ethnic group, that is, the Han Chinese. Its commonalities and differences resulted from the combined effects of the spatial order of dominant ethnic group, the plan arrangement, the material source, the economic strengths, the climates and the limitations of space. These findings not only enrich the study on architectural diversity in multi-ethnic villages, but also provide an inference on influence of the Han Chinese on the villages during ethnic migration history, and these findings are partially consistent with other studies result about the Sinicization of ethnic villages (Lu and Guo, 2021; Wen, 2021).

6. Conclusion

The aim of this research is to identify the spatial characteristics, commonalities, and differences of Guangxi’s defensive traditional architecture with Mozhuang Village and Guxietun Village as the examples, in order to preserve the architectural and ethnic components of these villages. This research took the recent trend of the rural
revitalization, village conservation and reconstruction in China as the research background. The three topics of Chinese defensive traditional architecture, multiethnic background of Guangxi, defensive traditional architecture in multiethnic village of Guangxi were systematically reviewed. The six research sites were selected from the two villages. Four research methods were employed, including literature review, field research, observation and space syntax analysis. The analysis was carried out from the five aspects, namely plan, elevation, construction material, masonry, and decoration. Based on these, the three results were drawn, which are as follows:

1) The spatial characteristics of Guangxi’s defensive traditional architecture were dominated by the ethnic group with the higher technological, cultural, or economic level.

2) The reasons for the commonalities of defensive traditional architecture were the spatial order of dominant ethnic group, plan arrangement and material source. These commonalities included the plans and layouts from the dominant ethnic group, the three types of isolated spaces (dangerous space, passive defensive space and active defensive space), and construction materials adapted to the local natural environment.

3) The determinants that contribute to the differences of defensive traditional architecture were the economic strengths, climates, and limitations of space. In general, economically stronger villages had more complex architecture, sturdier masonry and exquisite decorations with many cultural details; climate affected the thickness of walls, mixed material masonry and drains; external conditions played an important role in the small-scale defensive space.

The above three results are important for implementing the conservation and reconstruction not only in the two villages in question but also in other ethnic areas with a similar state of multiplicity and specific ethnic history. Future research could focus on building defensive multiethnic villages for ethnic areas with vague ethnic features or defensive spatial characteristics. Specifically, the following three overall suggestions are proposed:

1) In the upgrading process of villages and buildings, the spatial characteristics of the dominant ethnic group would be highlighted (the perspective of multiethnic).

2) The three types of defensive isolated spaces within the building must be preserved completely, and local construction materials adapted to the local climate would be utilized adequately, with subsequent maintenance kept up to date (the perspective of defensive traditional architecture).

3) For villages with low economic levels, conservation and reconstruction efforts would focus on the defensive village spatial texture, including some complex defensive buildings, public facilities, defensive designs, and narrow, winding roads (the perspective of village).

Finally, subject to the constraints in the research methods and research sites, the following deficiencies exist in this research: 1) Insufficient number of defensive traditional architecture and multiethnic villages in Guangxi. 2) The differences in defensive traditional architecture between multiethnic villages and single–ethnic villages are not covered. Therefore, the following issues need to be followed up and studied. 1) Finding more multiethnic villages with defensive spatial characteristics. 2) Exploring the differences in defensive traditional architecture between multiethnic villages and single–ethnic villages in Guangxi.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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