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The Cornice as a Means of Climate Control in Vernacular Dwellings in Xiang-Gan

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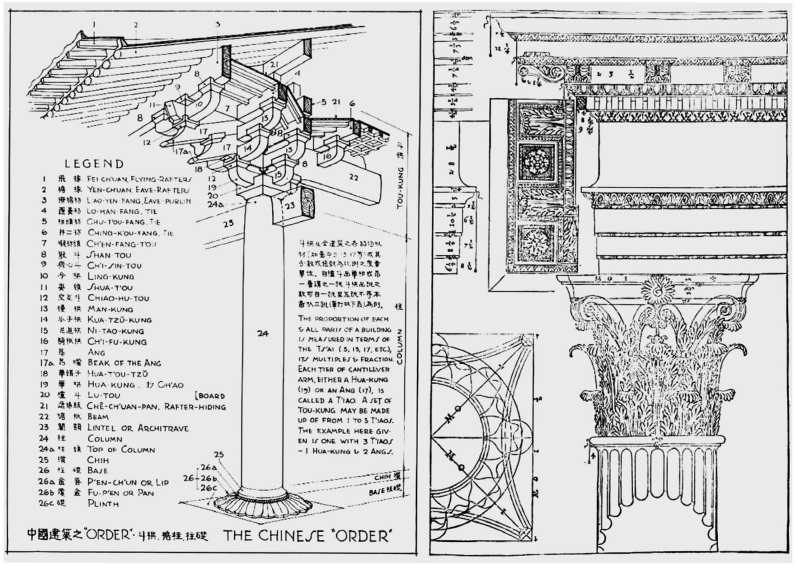
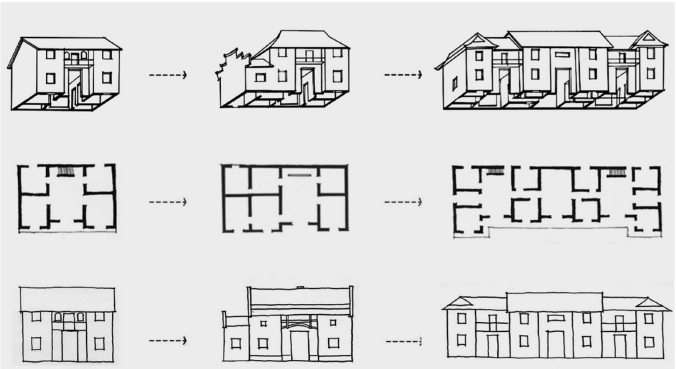
So famous that it has become proverbial, the Han-period roof, with its raised ridges and flying eaves, has monopolized much of the attention paid to Chinese architecture. Yet what happens in the shade of the roof merits closer inspection. Our topic is a vernacular element, a kind of cornice. This is not to force an analogy between "Chinese" and "Western" architecture, as Liang Sicheng did in his comparison of Chinese and Ancient Greek tectonics during the 1930s. fig. 1 Liang Sicheng postulated a "Chinese order" and thereby imposed a Greco-Roman logic upon his nation's architecture, just as Philibert de l'Orme before him did with the French order. Rather, my goal is to describe this element in its own context, hidden so well between the interior and exterior that it has escaped attention. Only a section cut reveals the concealed cornices of the dwellings of the Xiang-Gan district in southern central China.



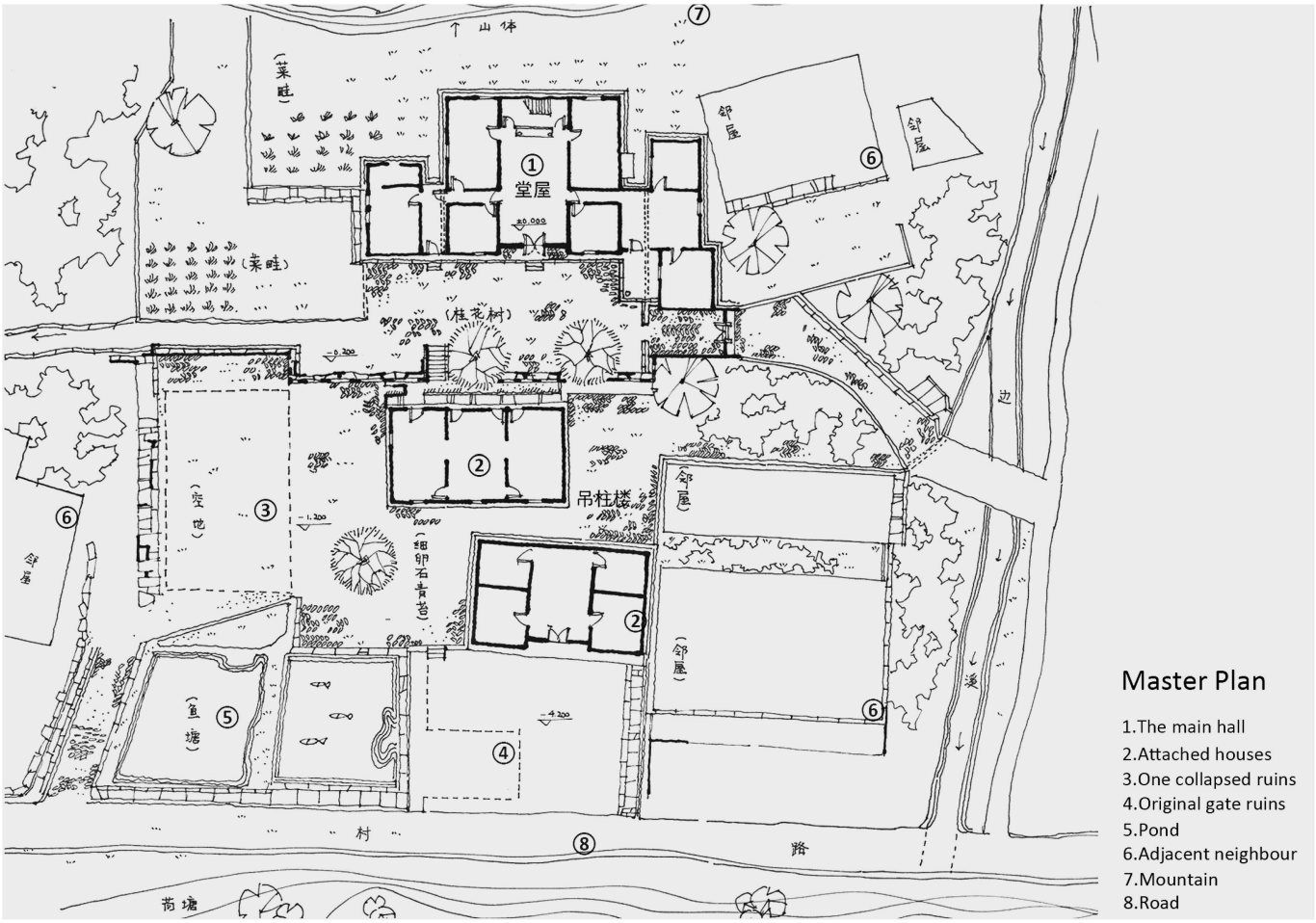
This cornice, which was examined in a recent field investigation, has a distinctive appearance that reveals both its geographical location and cultural history. The Xiang-Gan district comprises the

borderlands of the Hunan and Jiangxi Provinces. Surrounded by mountains to the south, east, and west and by the Yangtze River in the north, it has a harsh climate. fig. 2 The winters are especially cold and the summers particularly hot. Here, brought by ethnic migrations from north and south, the wooden architecture typical of the Jiangxi Province was fused with the



Hakka brick-building tradition of Southern China, notable for its spectacular round houses. This unique situation brought forth an equally unique cornice: between inside and outside, made from brick and wood, and combining climatic functions with aesthetic ideals.

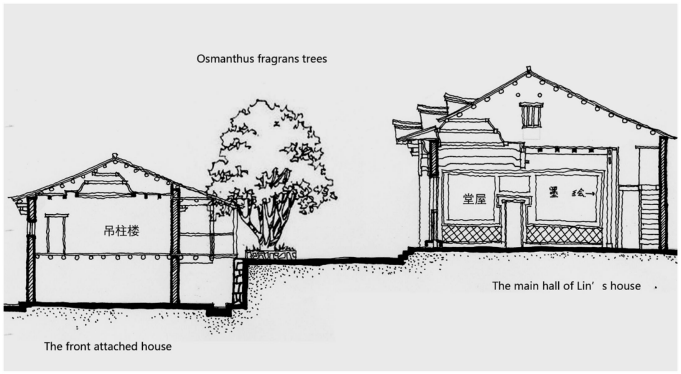
Traditional settlements in the Xiang-Gan border area are almost all plac-ed far from the flatlands. Migrants fleeing conflicts — most recently Hakka Chinese in the 1860s after the fall of the extraordinary Taiping Heavenly Kingdom — settled on mountainous slopes prohibitive to easy construction. The shortage of level ground resulted in a



relatively scattered layout, lack of central courtyards, and small building volumes. As the families grew, buildings developed along the mountains' contour lines rather than perpendicular to them. fig. 3 New parts were longitudinally added to existing ones, or entirely new buildings were placed on new level terraces. fig. 4

My drawings, reproduced here, represent Lin's house, a dwelling in Dacang, a village with a predominantly immigrant population in what was formerly Ninggang County, near Jinggangshan City. This remote village is located deep in the mountains, a good 300 kilometers from the capital city of Jiangxi Province, Nanchang. Only in 2017 did a road make Dacang accessible to vehicular traffic.

Lin's house has the largest dimensions and is the oldest structure preserved in the village. It was built around 1870, during the Qing Dynasty. While some parts of the building have collapsed, the bulk of the house has been preserved intact by the descendants of Lin's family. The house is situated on a narrow plot of sloped land, some 20 meters deep, on a rise of 4 meters. fig. 5 Like many dwellings in the area, the individual buildings of Lin's compound are situated on three platforms at varying heights. The extreme topography prevented the construction of a traditional courtyard house, common to other districts in Jiangxi Province. Nonetheless, influenced by the central yard typical of Hakka round houses, Lin's house features a large core volume and develops a linear sequence of rooms along the contour lines of the limited land. Originally, one would have entered Lin's house through a main gate and gained access to each platform by a corridor with suspended pillars.



In spite of the abundance of timber in the mountains, the immigrant builders still used brick, constructing masonry walls for better security and protection from the decay caused by wind and rain. The walls are built according to a local traditional technique that uses runs of bricks of different heights that produce an impressive striped effect. The entrance door to Lin's main hall is set in a

dominant position in the front facade and is conspicuously large in comparison to the small windows. In the absence of a central courtyard, the facade and main hall play the role of connecting adjacent spaces in the wings while at the same time regulating inner thermal conditions.

The door consists of two leaves: a lower one swinging inward and an upper one, set about 120 centimeters above threshold level, that swings out. Latching the lower casement closed and the top

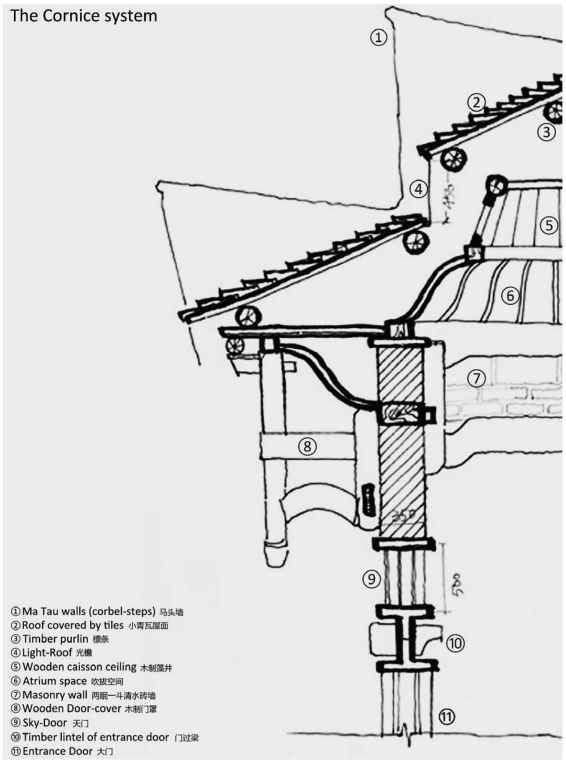
one open allows light and wind to enter and simultaneously keeps wandering farm animals out and young children in. The timber trusses holding up the roof consist of metasequoia, common in the

adjacent mountains. Because it often rains in the Xiang-Gan border area, traditional terra-cotta tiles are the most commonly used roofing material, laid directly onto the timber purlins so that the roof can shed rainwater quickly. fig. 6

Due to the high compressive strength and durable quality of the brick, the masonry walls are not sheltered by a significant overhang to protect them from the rain. A mere double row of slightly protruding bricks formally negotiates the transition between the walls and the eaves of the roof. Above the main door, which is accentuated by its own small protruding roof, the cornice becomes entirely absent; namely, a hole in the wall. This opening is called 天門 an "eyebrow window" in Allen G. Noble's classic *Vernacular Buildings* (first published 1974), and referred to by local craftspeople as a "sky-door" (*Tian Men* in Chinese). It 光檐 finds an echo in another horizontal opening in the roof, this one stretching from one gable end of the house to another. This so-called light-roof (*Guang Yan* in Chinese) serves as a sort of horizontal skylight that illuminates the room with light reflected from the rectangular wooden caisson ceiling. The ceiling itself is framed by a magnificent cyma recta cornice that constitutes the main interior decoration of the central hall.

In addition to bringing light into the house and highlighting its chief decorative element—the cornice-crowned caisson ceiling—this structure also

serves a climatic purpose. During the long rainy season, usually lasting from April to June (the so-called Plum Rains of the Yangtze River area), the most serious threat to local traditional dwellings is the constant damp. Indoor wooden structures and furniture need to be kept dry to prevent rot. Generally, humid indoor air can be expelled by cross-ventilation, but in the extremely wet local climate the relative humidity of the outdoor air is even higher than that of the indoor air. Increasing ventilation by increasing window size would thus actually worsen the situation.



Here the cornice plays another role. It encourages air circulation and combines this with solar gains. On a rainy day, solar radiation from the sky mainly comes from the diffuse sunlight radiating through the thick clouds, providing illuminating and heating effects. The orientation and position of the sky-door and light-roof let sun radiation in but obstruct the outdoor humid wind. The main air intake happens through the entrance door, the largest opening in the elevation. Heated by the sunlight penetrating through the light-roof above the cornice, the temperature of the ground and walls rises above the condensation point, causing the humid air to rise. This warm air can store more

water and, moving upward, transports the humidity outward through the light-roof opening. In addition, the caisson ceiling adds height to the domestic space and encourages air circulation in the main hall. All in all, this climatic as well as aesthetic system plays the role of a miniature indoor atrium, using convection to dissipate damp air. fig. 7

Unlike active techniques applied in modern houses, such as air-conditioning, this cornice achieves a passive environmental controlling strategy, called "space-conditioning" by Zhang Tong (see his article in the January 2010 issue of *Eco-City and Green Building*). The cornice system of Lin's house could thus be regarded as a miniature courtyard constructed on the facade, a classic architectural element adapted to the lack of land and harsh climatic conditions. The cornice in Lin's house reflects the elasticity of vernacular techniques that can be intelligently adapted to respond to the challenges of novel and demanding environments.

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fig. 1 Comparison of traditional Chinese timber architecture with Western classical architecture by Liang Sicheng (ca. 1935), one of the first generation of modern architecture theorists in China
Source: Liang Sicheng, *A Pictorial History of Chinese Architecture*, ed. Wilma Fairbank (Cambridge MA: MIT Press 1984), 7.

fig. 2 Historic photograph of Dacang village (date unknown)
Source: courtesy of the documentary office of Dacang village

fig. 3 Diagram of the development of local dwellings in mountainous topography
Source: the author, 2017

fig. 4 Masterplan of Lin's house within Dacang village
Source: the author, 2017

fig. 5 Masterplan of Lin's house within Dacang village
Source: the author, 2017

fig. 6 Cornice of Lin's house from outside; "light-roof" and "sky-door" with wooden caisson ceiling inside
Photographs: the author, 2017

fig. 7 The cornice's tectonic system; facade section
Source: the author, 2017