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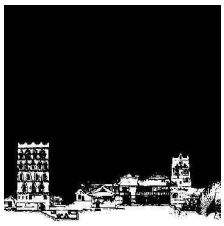

TRADITIONAL DWELLINGS AND SETTLEMENTS WORKING PAPER SERIES

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Traditional Dwellings and Settlements
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OLD WINE IN NEW BOTTLES: THE LOGIC AND EXPRESSION OF CONTEMPORARY CHINESE TRADITIONAL BELIEFS —— TAKE HOUTU GRANDMA TEMPLE IN YIXIAN COUNTY, BAODING AS AN EXAMPLE

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OLD WINE IN NEW BOTTLES: THE LOGIC AND EXPRESSION OF CONTEMPORARY CHINESE TRADITIONAL BELIEFS —— TAKE HOUTU GRANDMA TEMPLE IN YIXIAN COUNTY, BAODING AS AN EXAMPLE

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How contemporary life integrates with traditional culture has always been the key to the continuous development of culture. This paper takes Grandma Temple in Yixian County, Hebei Province as the research object, and focuses on its logic and performance in terms of religious form and Benefit Structure. The research finds that traditional culture can fully accommodate modern life, that only needs traditional cultural logic to meet the needs of real life. If you want a culture to continue to prosper, you need to make reasonable allocation from the benefit structure.

1. CULTURAL BACKGROUND

After the founding of New China, Materialism became the officially recognized guiding ideology, and traditional cultural forms such as Buddhism and Taoism were ordered to withdraw from daily life. However, for the masses with low educational level in China, how to face the hardship of their real life and confusion of the spiritual world has always been an important issue. The people are more willing to believe in the supernatural mysterious power than the government's help, which mainly advocates positive energy. Therefore, a close spiritual supply and demand relationship has been formed between the common people and the monasteries. That is to say, the cultural logic of Chinese people and mysterious forces has not changed for thousands of years. Houtu Grandma Temple of Hongya Mountain in Yixian County, Hebei Province is a very representative temple in recent years (Figure 1). It not only develops new religious content, but also experiments out new ways to manage the temple economy and stimulate the production of religious culture. Through the observation of the Grandma Temple, we can have a glimpse of the logic and expression of contemporary Chinese traditional beliefs.

"Houtu" is another name for the earth in ancient China. In ancient mythology, Houtu is a god in charge of all land affairs. From the Han Dynasty to the Jin and Yuan Dynasties, the emperor went to the Houtu Temple in Fenyin to offer sacrifices. In the Song Dynasty, Houtu was listed as one of the "Four Emperors" by Taoism. At the turn of the Ming and Qing Dynasties, Houtu was absorbed by folk beliefs, and the worship ceremony became a folk temple fair. At the beginning, the worship of Houtu was only natural worship, without temples and images. Later, the natural gods gradually personified, and completed the key transformation from male to female in the Sui and Tang Dynasties[1].

Fig. 1: Houtu Grandma Temple in Yixian County, Hebei Province. (Source: Xu Teng, 2016).

The worship of Houtu has at least two important functions in Chinese folk beliefs. On the one hand, because the land breeds all things and is an important material basis for people's survival, people express their expectations for life through the worship of Houtu. Contrary to the sky emperor, people call the land the mother of the earth, so the worship of Houtu is often associated with the worship of women. The names of "Empress", "Grandma" and so on appear in the plaque of the temple to vividly express people's kindness and gratitude to the land. On the other hand, because people return to the land after death, the Houtu also has the meaning of the god of the nether world. People express their fear of death through the worship of Houtu. In a word, the worship of Houtu is closely related to the daily life of the common people, including birth, senility, sickness and death. It is a very important folk belief.

According to the local people, Grandma Temple was built in the Han Dynasty. At that time, Wang Mang usurped power and wanted to kill Liu Xiu. Liu Xiu fled here. A grandma from Hongya Mountain dressed him up as a dead person, which saved his life. In order to repay her kindness, Liu Xiu, who ascended the throne, built the Grandma Temple for worship. This is just a folk tale full of loopholes. According to the Records of the Later Han Dynasty, the direct conflict between Wang Mang and Liu Xiu took place in Kunyang, which is now Ye County, Pingdingshan City, Henan Province, and Liu Xiu finally won.

The actual founding date of Grandma Temple is unknown, and the existing houses can only be traced back to the 1980s. It is said that before liberation, there were huge buildings on Hongya Mountain, and religious activities were very prosperous. All temples were destroyed during the Cultural Revolution. In 1987, Grandma Temple was confirmed as an open place for religious activities, and incense sticks began to revive

gradually. In 1999, villagers and believers paid for the reconstruction of Grandma Temple, which gradually formed today's pattern (Figure 2).

Fig. 2: Main Hall of Grandma Temple and Surrounding Buildings. (Source: Xu Teng, 2017).

2. COTEMPORARY EVOLUTION

In ancient times, the sacrifice to the Houtu may be simple and crude, and the object of sacrifice is the mound formed by gathering soil. In the Zhou Dynasty, Houtu was regarded as the main god of the state, included in the sacrificial rites, and regarded it as the symbol of the state power. Accordingly, the Zhou Dynasty also designed the mound in detail. The specific method is to divide the mound into five parts and use five colors, namely green, red, white, black and yellow, to symbolize the center and the four directions. In the early days, there was no temple for the worship of Houtu. After Houtu had experienced the transformation from natural gods to personality gods, China began to build temples for Houtu, and placed human shaped gods indoors for worship.

After being absorbed by folk beliefs, the nature worship at the national level gradually dissipated, and the social function at the secular level began to strengthen. Because of the direct relationship between land and motherhood, the benevolent functions of concluding marriage, protecting fertility and eliminating diseases were endowed to the worship of Houtu.

However, the religious functions of Grandma Temple in Yixian are not limited to the above. In order to attract as many believers as possible, Grandma Temple has carried out a bold reform of religion according to the logic of traditional belief and the needs of real life. First of all, the Grandma Temple has developed the functions that the immortals had in the past. For example, the function of the Moon Old Man was to make contacts so that single men and women could meet and know each other for the rest of their lives. The Moon Old Temple in Grandma Temple has added the function of reconciliation, so that the contacts made by the Moon Old can occur not only between men and women who do not know each other, but also between lovers, couples and friends, increasing the coverage of the Moon Old Man's magic (Figure 3).

In addition, Grandma Temple enriches the interaction between believers and immortals. The traditional Chinese monastery atmosphere is quiet, which warns the worshipers to be full of awe. Grandma Temple rejects this man-made estrangement, allows believers to touch the hands of God of Wealth at will, and encourages this behavior with slogans such as "touch the hands of God of Wealth, and God of Wealth will follow you", which shortens the distance between people and God and creates a rare sense of intimacy (Figure 4).

More importantly, the Grandma Temple has also created a number of new gods that did not exist in the past but are now in great need, such as the God of Vehicle to protect driving safety, the God of Learning to protect successful examinations, and the God of Official to protect promotion in the workplace (Figure 5). In recent years, the number of family cars in China has increased dramatically, which means that people are facing increasing travel safety risks. Therefore, it is necessary to pray for God of Vehicle to protect their own safety and that of their families. Grandma Temple invented the new god in this case. According to the traditional Chinese rules of shaping immortals, a deity must have its own distinctive features in appearance, clothing and magic tools. The God of Vehicle in Grandma Temple is not characteristic in appearance, and the clothes are generally treated as traditional green robes to convey a long-standing sense of authority. The magic tool used by God of Vehicle is a steering wheel. This design makes the function of God of Vehicle clear at a glance (Figure 6 - Figure 7). The God of Vehicle represents the typical logic and expression of Grandma Temple in creating immortals, that is, modern life needs to inspire creative behavior, and popular and clear magic tools confirm the function of immortals. A doll was placed directly on the hand of a god who was blessed to be born(Figure 8). Both the God of Learning and the God of Official mentioned above have their own unique magic tools. The God of Learning holds a box of ball pens in his hand, and the God of Official holds a seal in his hand.

Fig. 3: Grandma Temple adds the function of reconciliation to the Moon Ancestral Temple. (Source: Xu Teng, 2016).

Fig. 4: Guide to God of Wealth in Grandma Temple. (Source: Xu Teng, 2016).

Fig. 5: New God Created in Grandma Temple. (Source: Xu Teng, 2016).

Fig. 6: The God of Vehicle in Grandma Temple holds the steering wheel. (Source: Xu Teng, 2016).

Fig. 7: Mural of the God of Vehicle. (Source: Xu Teng, 2016).

Fig. 8: Dolls as a magic tool in Grandma Temple. (Source: Xu Teng, 2016).

4. CONCLUSION

The Grandma Temple is operated by Matou Village at the foot of the mountain. The village name contracts the corresponding hall according to its family's economic strength. The religious theme and the shape of the statues in the hall are all decided by the villagers themselves. In order to attract attention, they will use very exaggerated modeling, which itself changes the original appearance of religion. Due to unstable operation, the small halls of Grandma Temple often change the theme, so what is enshrined in the next hall is always a mystery. Grandma Temple changes the fixed narrative structure of traditional religious buildings, which makes the whole temple more like a commercial pedestrian street with religious themes.

The experience of Grandma Temple has inspired new ideas for the continuous development of culture. In the past, when China carried out the protection of traditional culture, it generally preferred the following two aspects of work: the maintenance of physical environments such as buildings and the collection of historical materials such as documents. Both aspects of work were trying to find physical evidence for a period of time in the past. However, this kind of museum work just sealed the culture in the past, which actually cut off the possibility of sustainable cultural development. The continuous development of culture requires that each period of time can produce its own cultural stories and form a continuous narrative. It is a good way to keep stories happening and maintain cultural vitality by retaining cultural logic and creating new forms of expression in full combination with practical needs.

3. BENIFIT STRUCTURE

Chinese native researchers are used to viewing folk religion as a cultural or artistic phenomenon. Few studies touch on the benefit structure behind folk religion. However, an obvious and overlooked fact is that culture is a social process. Only by properly handling the practical interests of all parties involved in culture can culture continue to produce and maintain vitality. Therefore, the competition and negotiation of benefit behind culture often determine the reality of culture.

Chinese religious belief has always been based on real life. The temples provide comfort or guidance for the poor life of the common people through their ability to explain mysterious forces. The common people express and confirm their sincerity by giving back a certain amount of money. Usually, the more they give back, the greater their sincerity, and the more they will get the blessing. This is actually a spiritual supply and demand relationship about life doubts. Money is an important measuring medium. Because the logic is clear and the audience is very large, religion has always been a good business.

Matou Village is the operator of Grandma Temple, which is managed by individual contract system. Contracting is divided into two levels. The first level contractor is the original shareholder, who signs the contract with the village committee and pays the contract fee. There are more than 700 households in Matou Village, and more than 400 households are the original shareholders of Grandma Temple. Each temple area is contracted by tens to hundreds of villagers. The main hall has the largest number of 181 households, the front hall has more than 50 households, the middle hall has more than 20 households, the back hall has more than 30 households, and the God of Wealth Hall has 100 households. The original shareholders will auction the management right and the income right, and the highest bidder will become a secondary contractor. The secondary contractor is the actual operator of the temple. The prosperity of the temple house is directly related to the actual income of the contractor. Therefore, secondary contractors need to find ways to improve

the competitiveness of their temples and try to retain pilgrims. Creating attractive statues is a business method agreed by many contractors. Because of the rich and diverse religious supply, Grandma Temple has been operating well in recent years, with an annual income of nearly ten million yuan. The village collective can also earn 440, 000 yuan per year because of the contract costs. The first level contract is signed every few years, and the village committee will adjust the contract amount appropriately according to the actual operation. The secondary contract only has oral agreement[2].

The individual contract system not only stimulates economic income, but also brings contradictions among villagers. In order to maintain fairness as far as possible, the village committee took out the main hall of Grandma Temple separately, encouraging all villagers to participate and share benefits. However, the remaining temples are contracted on the basis of the family's economic capacity. The front hall, the middle hall, the rear hall, the God of Wealth Hall and other main halls are covered by powerful families. Families with ordinary financial ability can only contract some small temples along the road. Families with difficulties can only build simple shacks on both sides of the incense road to sell religious goods such as firepaper, incense and candles for a living (Figure 9). The villagers refused to sign their names revealed in the interview that the imbalance of income has caused mutual resentment among villagers. For example, the village director is the most powerful people in the village, the management idea of Grandma Temple is proposed by the village director, and his family runs the cable car on the mountain. The village secretary and a villager engaged in construction are an alliance, and they gain benefits by building houses and roads. On the surface, the two businesses do not intersect, but they secretly calculate their own gains to avoid losses. A villager who opened a small shop at the foot of the mountain accused the director and the secretary of dividing the income of the village and not allowing ordinary villagers to share the welfare.

Fig. 9: Blue color steel plate hut for selling religious articles. (Source: Xu Teng, 2016).

Since Grandma Temple have earned money in recent years, the conflict between Matou Village and the government of Yi County has become fierce. In terms of ownership, Grandma Temple belongs to the county government. At first, Grandma's Temple was a small dilapidated temple, which was directly managed by the county government, township government and village committee. However, due to the high cost of human and material resources, the government could not afford to support it financially, so it was difficult to sustain it. Later, the individual contract system was implemented according to the market discipline, and today's business results were achieved. Facing the high annual income of Grandma Temple, the county government hopes that in addition to the basic administrative expenses, it can also share a portion of the profits from the annual income. The villagers of Matou Village were not willing to share their labor income, so the two sides formed a stalemate. When the contradiction is stable, various departments of the county government will visit Grandma Temple one month before the temple fair every year. On the face of it, they will inspect and describe the preparations for the organization, but secretly they hope that Matou Village can pay a certain amount of money in advance. When the contradiction is fierce, the county government will use its administrative advantages to initiate rectification of Grandma Temple. In 2007, the government of Yi County determined that six major temple areas, including the front hall, the main hall, and the back hall, were legal religious areas, and all the other small temples were demolished.

The contradictions among villagers and between villagers and the county government focus on the way and proportion of benefit distribution. All parties have no opinions or concerns about the religious form of Grandma Temple. When the Granny Temple rose to the national level, the simple and crude religious form and the pursuit of profits had a serious conflict with the national mainstream cultural concepts and values. After the founding of New China, all religions were considered to be feudal superstitions. After the reform and open, although some religions were allowed to rebuild their own belief system, they were also subject to strict supervision by the government, which must not affect the government's ideological education to the people. From the perspective of the public, religion has always been described as a pure spiritual activity, and its holiness will be greatly reduced if it is related to money. On the one hand, the rise of the Grandma Temple made the country see the weak coverage of the main idea at the end of society, and also made the public realize their shallow understanding of the deep binding of religion and money. Therefore, on November 23, 2017, 12 departments including the State Administration of Religious Affairs jointly issued a document to address the commercialization of Buddhism and Taoism. Article 1 of the document states verbally the non-profit nature of religious sites, forbids commercial capital to intervene in religious undertakings, and no organization or individual may invest in or contract to operate religious sites. The remaining nine can also be one-to-one corresponding to the current situation of Grandma Temple (Figure 10). After a year and a half of negotiation, the mobilization meeting for comprehensive management of Hongya Mountain in Yi County was held in Liujing Township Government. The government of Yi County renovated Grandma Temple according to law, but the action was limited to spraying a lot of slogans and removing some illegal buildings. The contract system of Grandma Temple survived.

Fig. 10: CCTV's report on Grandma Temple. (Source: Xu Teng, 2016).

4. CONCLUSION

The Chinese folk belief tradition has a long history. People create different types of gods according to their real life needs, which is the most basic logic and expression of religious action. The supply and demand relationship between religion and real needs has always existed, so the emergence of new immortals in the new state of life is in line with cultural logic, which reflects the growth of traditional culture in the contemporary context. However, to maintain vitality, a cultural form needs the support of a business model. The case of Grandma Temple at Hongya Mountain in Yixian County tells us that people will only participate in the production of culture if the distribution of benefits is reasonable. Only when there is space for increasing benefit, people will be involved in cultural innovation activities.

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RUPTURING TERRACOTTA: ENTANGLED EXCHANGES OF THE HAND AND THE MACHINE IN SOUTH INDIA

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RUPTURING TERRACOTTA: ENTANGLED EXCHANGES OF THE HAND AND THE MACHINE IN SOUTH INDIA

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The paper explores how a colonial produce, such as the flat terracotta Mangalore tile has come to be the new vernacular of the region, redefining indigenous. The handmade cylindrical tiles, made with the individual imprint of each potter, transformed into a mechanized flat tile, by the 19th century European Colonial Engineers. This colonial interception, aided by the industrial revolution produced a slow but profound rupture in method and making. The paper argues that the encounter between the indigenous and colonial construction processes produced a rupture in making and complicated the language of architecture in South India, forever.

1. INTRODUCTION

The arrival of colonial agencies in the Indian sub-continent was a rupture in the tradition of architectural 'making'. There was a stark productive tension between the processes of the colonial and indigenous. To identify this rupture in architectural 'making', it is imperative to understand and read the architecture of the 19th and 20th century from a decolonial construct, as the existing knowledge from the 18th and 19th centuries, when read from the traditional archives, obscures the overlaps and intersections of processes that were occurring between the British Engineers working in India and the indigenous craftspersons. To decolonize the reading of architectural productions and the processes of making them, traditional archives have to be read to elucidate the biases of race, class and caste that heavily resides within these texts. These texts include the PWD manuals/treatise written by British Engineers in India, the Professional Papers on Indian Engineering (an 8 volume series written by British Engineers working in India) among other documents. Along with the reading of the archives, when the numerous existing, some still in use architectural productions from the 19th century are measured, studying the tectonic and material making, and juxtaposed against the findings from the archival texts, it generates alternate approaches to interpret architectural history of colonized lands. In this paper, I take the example of terracotta roofing tiles and bricks to elaborate on the cases of intersection of the colonial and indigenous, of the handmade and the machine made. The argument that I make is not to just include "non-western" geographies but to provide an alternate lens to understand architectural history in the decolonial realm, through its rupture in time. While studying the architectural productions through this rupture created by colonial intersection, it becomes crucial to understand the shift from hand made to machine made productions in architecture too, which is elaborated through the paper.

The influence of the 18th and 19th-century colonial processes has formed the basis for 20th-century construction practice in modern India. The repercussions of the rupture created by colonial and indigenous

intersections can be seen in the course of construction processes of architecture in the 20th century, as engineers and architects follow these manuals (written by the 19th century British Engineers) even today in India. I have extracted excerpts from texts written by British Engineers, missionaries who trailed the colonizers and set up factories in South India and other regional elites, kings and people in position of power to understand specific processes of making and use of terracotta in architectural productions through a decolonial framework. The voice of the craftsperson has always been missing in the written records but careful examination of these texts, while juxtaposing them against the primary data/measurements/analysis from the buildings has illuminated the contributions of the local craftspersons. The paper argues for a nuanced narrative of architectural history, the rupture created by mixing of indigenous and colonial productive tensions through examples of terracotta making and use in architecture. While I use the examples of terracotta in the form of roofing tiles and burnt bricks in India, all the cases demonstrate the intersection of handmade processes being taken over by mechanization in the industrial age that the British Colonizers worked in India, creating a ruptured history of architecture.

2. THE TERRACOTTA ROOFING TILES – 19th CENTURY

The 19th century presented a forecourt for the intermixing of processes in architecture in the subcontinent. The Industrial Revolution at its peak, fueling a world moving towards machines, patents and mass production, combined with European colonial influences in the Indian subcontinent, resulted in the overlap of handcrafted and machine-made architecture in 19th-century India. Extensive mechanization in Britain, and its introduction in processes of architecture by British Engineers in India, brought about these overlaps. In the following sections I elaborate the making of terracotta roofing tile as an element of architectural productions, the sift to mechanized production from a handmade process and the repercussion of this intermix of methods on the manifestation of architecture in South India.

2.1. Uniformity and Precision in Terracotta Tiles

I elaborate this shift from handcrafted to machine-made through the example of terracotta tiles, used extensively in South India. The making of cylindrical terracotta tiles on the potter's wheel was a common sight in the whole of South India in the 18th century (Fig 1). These tiles adorned the roofs of small and big buildings all over the countryside, but this changed with the arrival of the Basel Mission on the coast of South Canara Region in South India. The history of the Basel Mission and the industries it set up become important as they triggered the production of machine-made tiles and bricks for architecture. This change from handmade potter's tiles to tiles produced by machines in factories brought about changes in production processes, scales and attributes, which changed architecture itself.

Fig. 1: A potter in rural Karnataka, working on his wheel with his hands, making country tiles. Handmade terracotta tiles are also seen on the roof of the structure. (Source: Kaup Jagadish, 1980).

As early as 1780, the German Christian Society was founded in Basel by the Pietists of the South German state of Wuttenberg. The Basel Mission Seminary was established on 26 August 1816. This organization was established in Basel, Switzerland, and was operational in India in the Madras Presidency from 1831 onwards. From 1831 to 1920, the mission was involved in many industrial and commercial activities in the Malabar and South Canara regions of South India. [1] They started with experiments in traditional crafts like agriculture and weaving, and later switched over to modern crafts like watch making, bookbinding, printing and tile making. These economic activities were in addition to the very obvious and sizeable religious and social activities that the mission undertook. The Basil Mission established handloom weaving establishments, tile factories, printing presses, and a mechanical workshop at Mangalore during this period. [1] The Mangalore roofing tile was the most popular and widely used machine-made product of the mission. Prior to this machine-made tile, the potters handcrafted each tile on the wheel or with molds. Each handmade tile had the leeway to vary a bit from the other in shape and size according to the local soil used and the skill of the craftsperson. The machine-made tile was precise and uniform. Basically, the production processes were completely altered by the industrial mass production introduced by the mission in the region.

2.2. Tile Industry of Mangalore

The demand for tiles increased many-fold in the 19th century when buildings for public offices, railways and larger uses were built by the British in South India. The traditional tile maker was handicapped in exploiting this new demand. The problem with the use of traditional tiles was that it required a heavy superstructure. Thus, the stage was set for the rapid expansion of the Basel Mission's machine-made roofing tiles. [1] George Plebst was a mechanical engineer from the Basel Mission who started a workshop for tile making in Jeppo, in Mangalore in 1865. Trained in typographic printing, Plebst had landed in India in 1851 to introduce letterpress printing in Kannada and later Malayalam and Tulu. [2] Plebst had first worked on the conversion of the Mission Press from a lithographic one to a typographic one. Ten years later, when health reasons forced Plebst to return to Europe on leave, he suggested that pottery might be a suitable field for the mission. He had noticed that Indian pottery and tiles were not glazed, and asked to learn the necessary skills to make glazed earthenware products. He returned to Germany to study the technique of tile making which included the treatment of clay, the technique of glazing, the construction of the kiln and the baking process. While Plebst was learning some techniques in Germany, there was a constant transfer of knowledge between Europe and India. The mission sent priests to network for information and business.

> A member of the Basil Mission Industrial committee wrote to Limoges, the center of fine China in France, to enquire about suitable glazes. The reply said somewhat condescendingly that no suitable information could possibly be found in Limoges, where porcelain, not earthenware, was made and glazed with almost pure quartz. The correspondent did however offer to have samples of Mangalore clay analyzed by the best specialist in Sèvres who might be able to help. The exchange of information, knowledge and know-how was constant during these times. The committee in Basel drew on priests and business networks to get information or arrange training for mission people. (Stenzl[2])

On his return to Mangalore in 1864, with the help of a proficient local master potter, Plebst built his own kiln and conducted experiments in tile making, which were successful. [3] Clay, the raw material for the manufacture of tiles, was found abundantly on the banks of the river Netravati in Mangalore. In 1865, the first tile factory was started at Jeppo, Mangalore, employing two workers and bullock power, producing 360 tiles daily. The factory was known as the Basel Mission Tile Works. The workshop was soon expanded, employing 60 workers by 1871 and 131 in 1880. [3] The factory made 209,000 tiles a year by 1870. By 1873, the tile factory had paid back its entire investment. The experiments by George Plebst produced tiles that were lighter and more waterproof compared to the local tiles. The tile works were to become the largest and most rapidly developing mission industry. Due to the demand and the scaling up of the manufacturing unit, improvements and expansion

continued, and in 1880, just before steam power replaced the bullocks, production in Jeppo near Mangalore had reached a million tiles per year. In 1907 the Mission Trading Company employed 3,644 persons in trade and industry in India. By 1913 it was the biggest industrial entrepreneur in South Canara and Malabar. The profit covered about a quarter of the mission's yearly expenses in India. In 1881, bullock power was replaced by steam power. Initially, the factories produced flat tiles different from the curved and grooved types which are presently being used for roofing. Subsequently, the factories built ridge tiles, both plain and ornamental skylights and ventilators, ridge and hip terminals, finials of various kinds, grooved sphere tiles, hanging wall tiles, ceiling tiles of many different designs, hourdis or ceiling slabs, common and ornamental clay flooring tiles, chimney bricks, salt glazed stone and earthware, drainage pipes, terracotta vases and flower pots (Fig 2). The market for tiles covered the entire British Empire, and the mission made extensive use of the trade channels that existed within the empire. [1] This was the time when the handmade half-cylindrical shaped country tiles were replaced by the variety of flat tiles produced in the Jeppo factory and subsequently elsewhere. The influence of industrialization on local know-how changed the form of materials and processes of making and subsequently changed the way buildings were made or techniques were used. The mechanization of processes through steam power and gas kilns allowed for uniformly fired earth products, which were mass produced. Conversion of the existing kiln to a gas firing kiln helped obtain a uniform temperature for producing other ceramic articles like salt glazed tiles and terracotta ware. While other units of the Basel Mission specialized in mass-produced articles, the Jeppo factory continued to manufacture specialized products and remained an experimental center for product development (Fig 2). While talking about the mechanization of the tile industry in Mangalore it is also important to point out the suppression and obliteration needs to be mentioned. As mentioned before, Plebst was acknowledged but the local mason who worked was not specifically named. This instance of suppression is important to note, as the Basel mission authorities refer to the contribution of the potter without his /her name while they acknowledge the name and work of George Plebst, the European counterpart. The other exclusions that are pointed out, apart from the exclusion of the local potter's expertise in making Mangalore tiles, is the British Engineer Havilland's experiments of the dome at the St. Mary's Church, Madras, the well foundation of St. Andrew's Kirk, Madras (Fig 3) and the native methods of well sinking which are discussed in the later sections of this paper. The British engineers appropriated the native knowledge without acknowledging the local expertise.

Fig. 2: Various products of the Basel Mission tile factories. (Source: Basel Mission Archives, 2017).

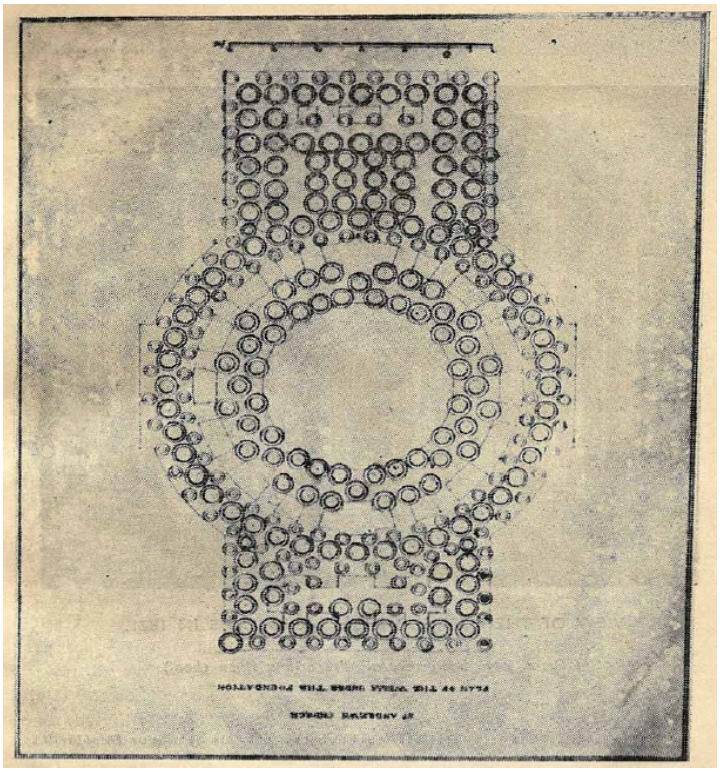


Fig. 3: The well foundation of St. Andrew's Kirk in Madras. (Source: https://www.thekirk.in/roots.php, 2020).

2.3. Changes in Terracotta Tile Making

The earliest tiles were made on the potter's wheel as cylindrical objects that were divided into two halves and fired. Today, in most of India and especially South India, the handcrafting process of making tiles is almost extinct, and the tiles are flat and interlocking (known as Basel mission/Mangalore tiles). The appearance of these tiles and their use are completely different today. As a consequence of the change in processes of production, the aesthetic and tectonics of architecture have changed. Vernacular tile making was contextual, using specific skills to fulfil specific needs. These tiles were made with locally available clay. The skill of the potters, their knowledge of the soil and the strength and weakness of the material helped create these tiles, which were used as roofing material for rural and urban scapes. The process of making and using these tiles varied with geography. Parameters such as the quality of soil, local knowledge of building kilns and climatic needs defined the processes and making of these tiles. The two main methods of vernacular tile making that artisans followed were tiles on the wheel and tiles made with molds. In the first method, the tiles were made on the potter's wheel in a cone shape, cut into halves, and baked in a kiln. These were mostly rudimentary, and varied in shape, size and thickness. The other method was to lay a sheet of rolled clay on a flat surface, in a form or mold of the required size, shape and thickness (Fig 4). The sheet then was removed and shaped by placing it on a semi-cylindrical wooden block; it was dried in the shade and baked in a kiln. The potters in the Konkan region of Maharashtra and Karnataka practice this method today, as well as the tribal communities of Gujarat. The raw material for the tile is fine clay taken from the fields or riverbeds. The simple equipment required for making these tiles consists of the following: a flat wooden base to make a clay sheet; a form made of bamboo or wood strip (6 × 6 mm) for a common tile; a larger form for the ridge tile; and half-round wooden molds—one for the common tiles and another for the ridge tiles—to shape the clay sheet. The top of the base plate is sprinkled with dry ash from a chulah (hearth) to prevent sticking. Prepared clay is spread, pressed on the base in a frame, compacted by hand and smoothened by spraying a little water. The clay sheet is then removed, placed on the mold and shaped. The mold is removed and the raw tile is left for drying for a day or day and a half. The dried tiles are baked by placing them in rows with gaps in between them, filling and covering them with fuel. If the area is windy, then the kiln is formed in a shallow pit, to prevent fuel from burning out fast, resulting in the tiles being half-burnt or over-burnt. The clay is cleaned of roots, gravel, etc., then wetted, tempered by foot, and allowed to season for two days. The fuel required for baking poses no threat to forest, as leaves, branches, grass, rice husk, cow dung etc. are used as fuel. These processes of making country tiles or potter's tiles resulted in tiles that were different in size and curvature depending on the quality of clay available.

Fig. 4: Clay tiles made with hand. (Source: Gaatha. https://gaatha.com/clay-tile-india/, 2018).

2.4. Other Terracotta Tiles

In the mid-19th century, the use of the half-cylindrical country tile was already dwindling and being replaced by many versions of factory-produced tiles that were produced by the colonizers, including British military engineers, missionaries and others. A few decades before the Basel Mission tile had gained popularity, British engineers were designing and propagating other formats of terracotta tiles. Some of them were new, tweaked design variations and some were new designs that could be used in combination with the existing country tiles. These are evident overlaps in the use and production of native and European types of tiles and need a mention here to understand the tectonic intersection.

The Goodwyn tiles first manufactured in 1850, the Basel Mission terracotta tiles manufactured first in 1864 and the Atkinson tile laying all represent the start of mechanized processes in tile making. These tiles were later standardized through the PWD (Public Works Department) manuals from 1850 onwards. The British engineers had a bias towards standardized formats of elements of architecture, and tiles were no different. J. N. Sharp, a British military engineer working in India, wrote in his paper on the Goodwyn tiles in 1863-64 that the country tiles made by local potters were uneven, imperfect, and were made in small sizes and frames of bamboo that were non-standard and pervious. [4] Evenness and uniformity were attributes that the British engineers associated with good tiles. The standardization of architectural elements was thus seen as a progressive interchange in the history of technology. This also meant that standardized architectural elements, such as roofing tiles, plasters and even brick sizes were normalized in the 19th and 20th centuries. The standardization of the tiles and bricks also meant standardization of other elements of architecture that were

required to form the tectonic of the structure. Bricks of a standard size make rooms modular, and consequently doors, furniture layouts, etc., also become standard. In the case of Goodwyn tiles, Sharp describes the frames on which the tiles rest as being of a prescribed, predetermined size (Fig 5):

> "Deodar battens 3" x 2" are nailed on the purlins at twelve inches from center to center on which are laid twelve inch square tiles, two inches thick, well fitted, cemented at the joints and pointed underneath; a layer of good mortar about one and a half inches thick is then laid, in which the pan-tiles and over them the round tiles carefully fitted and set. The eaves terminate in a masonry cornice, and the ridges are covered inn with round and flat tiles, expressly made for the purpose; gable end have been adopted as better suited to this description of tiling; the slope of the roof 28 degrees" (Sharp 1863-64, 134 [4])

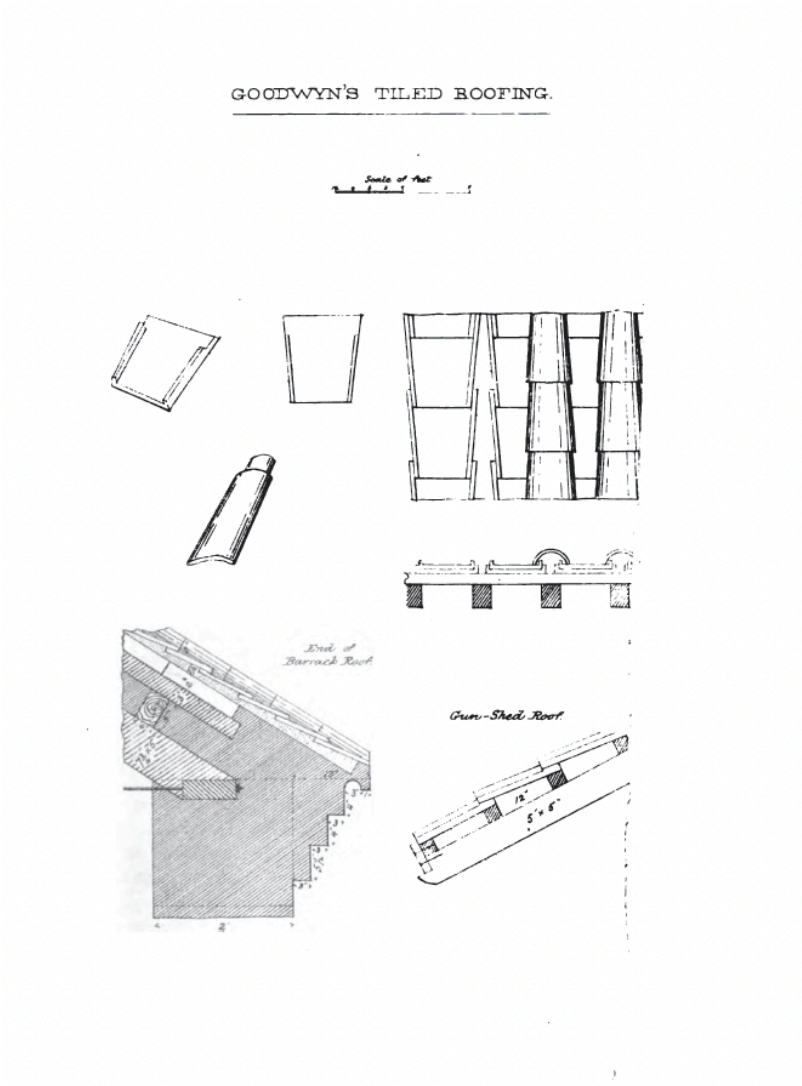


Fig. 5: The Goodwyn tiled roofing drawings that were first published in 1864 (Source: Peile, 1864 p134).

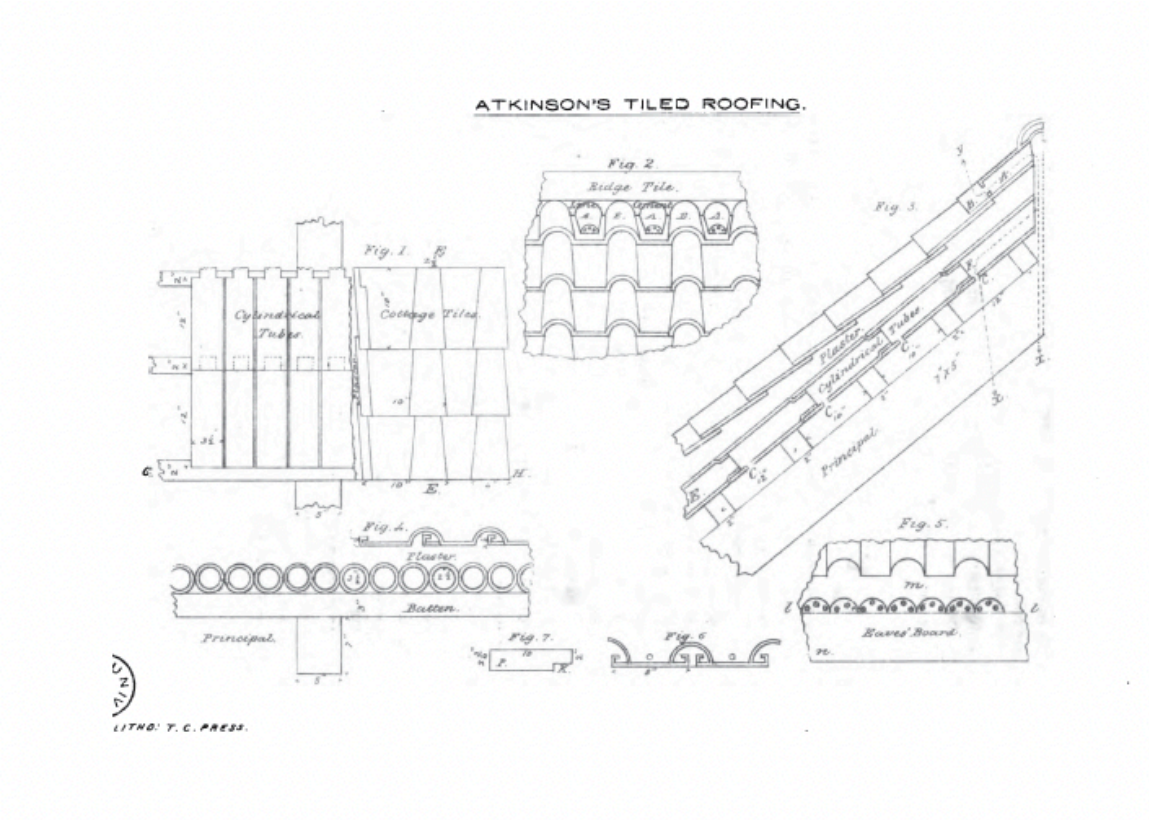


Fig. 6: The Atkinson tile roofing drawings that were first published in 1864 (Source: Peile, 1864 p490).

Standardization is given such high importance that the weight of each tile and not just the size is prescribed in the specifications. The terracotta tiles and their laying is another example that enforces the conception of normalization of architecture through standard practices. In the roofing elements, PWD documents in 1875 mention some of the local tiles called the Belgaum tiles, named after the region:

> "Consists of a layer of small flat tiles about 5"x5"x1/2" with edges rubbed to make close joints, and soaked in pure white lime of about the consistency of cream, laid in mortar on sawn teak battens 2"x1/2" placed 3" apart; over them a layer of mortar and then a layer of ordinary native semi-cylindrical tiles about 4"x5" is laid, eaves and ridges sot in mortar.
> Note. – This makes a very nice roof." (Marryat 1875 [6])

Apart from the description of the tiled roof specifications, it is important to note that the author in the description recommends the roofing detail combining the Atkinson tiles (Fig 6), which were developed by the British engineers, with the native semi-cylindrical tiles, which were made by the local potters. [5] It is a case of evident intermixing of native and European tile design to form a concoction of practices that preceded 20th-century practices. The transition from the handcrafted, native techniques to a standardized, uniform practice

of architecture is laced with such instances of intermixes. The standardization of terracotta roofing tiles became a part of the standardized manuals and consequently was added to the PWD manuals. The Atkinson tiling pattern is comprehensively elaborated in the paper by with diagrams and text, describing the use of the factory-made flat tile and the semi-cylindrical country tile. [5] An account of the Abbottabad Church in Punjab describes the use of terracotta tiles, which were produced as standardized roof covering elements:

> "Ventilation, cylindrical and pantile roof.- Atkinson's pattern consists of two layers of tiles, the upper being Italian pantiles, laid in cement over cylindrical tiles. The cylindrical tiles to be 12 inches long, 4 inches external diameter and half inch thick, fitting one-half inch into each other, with a shoulder and socket joint; a lip, to rest on the timbering, to be raised on at half an inch from the shoulder; two holes, of half inch diameter each, to be pierced through the tile in line with the lip which is on the lower side of the tile. The tiles to be molded of well-tempered clay, thoroughly burnt, sound, and of true shape, without taper." (Blair [7])

The building of this church (built inn 1864) involved specifications regarding the roofing tiles, which were standard practice by the time. This included the earthwork, stone and fixtures, which had defined specifications. For example, the foundation and plinth were made with hammered dressed pukka stone rubble masonry with lime cement in equal parts lime, sand and soorkhey (powdered broken burnt brick, locally called surkhi today in India, is used as fine aggregate inn time mortar). This was elaborately mentioned in the PWD documents of the time too. There are numerous examples of buildings commissioned by the British government and built by British military engineers in India which use specifications of completely standardized elements of bricks, mortar and more. The Punjab exhibition buildings, designed by Edwin E Baines in 1863, the Rangoon Custom House built by Capt J. M. Williams in 1863 and the Cawnpur Memorial Church designed by Walter Granville in 1861, an engineer, all use standard British sizes, i.e. 23 x 11 x 7.5 cm.

2.5. Mechanization in 19th Century India: Tiles, Bricks and More

The processes of architecture and engineering were being mechanized in India and around the world in the 19th century, from railway engines and machines for raising water to kilns and mixers in the brick and tile industry. [8] An indication of the extent of percolation of mechanized means into the colonies may be had from the accounts of a saw mill constructed on the river Chenab in Punjab. Imports of machinery from England comprised more than one-third the total cost of the building itself (Fig 7 and 8). Brick making in the various regions of India undertaken by British engineers was a task that intermixed local and European techniques, introducing machinery and mechanized means of production in various forms gradually. Machinery was near the top of the list of chief imports into India by British engineers in the 19th century.

"The chief imports are: -cotton and woolen goods, machinery, metals, wine, spirits and malt liquors, military and naval stores, railway materials, ivory, spices, silk sugar team coffee, tobacco, horses, drugs and dyes, fruits, precious stones, books and stationery, grain, seed, oil, timber, icem apparel and treasure. These are derived from the United Kingdom, Africa, China, Penang, Singapore, the Straits of Malacca, the Persian Gulf, Suez, Calcutta, Malabar, North America, the Arabian Gulf, Batavia and Java, Ceylon, France, the Mauritiys, Aden, Cutch and Guzerat… n the methods of executing the works two objects have to be kept in view, first, to turn those of the natives to the best account; and secondly to introduce English appliances where it can be done with advantage." (Berkley. [9])

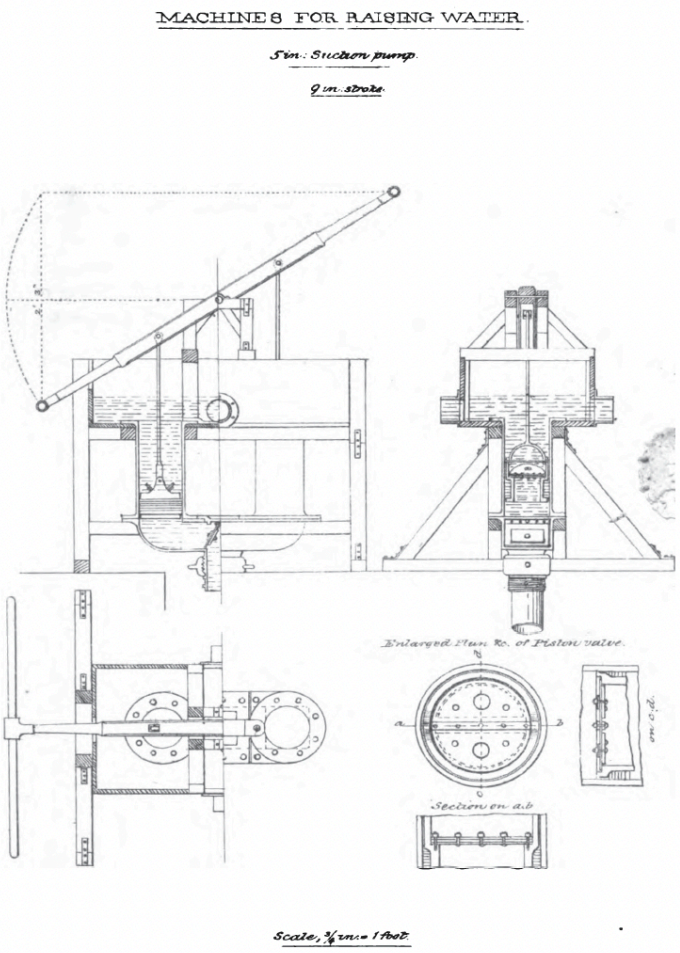
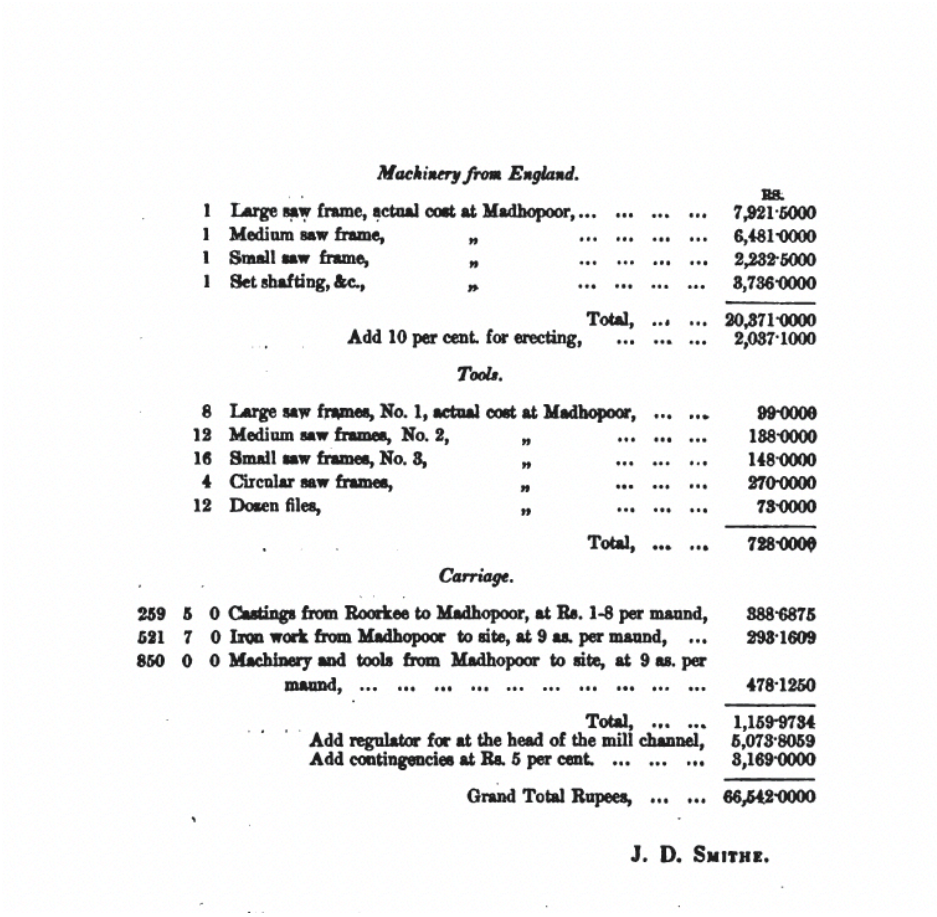


Fig. 7: Machine for raising water created by 19th-century British engineers. (Source: Professional Papers of Indian Engineering, vol. 1, 1863-64).



Machinery from England.

			Rs.
1	Large saw frame, actual cost at Madhopoor, ...		7,921·5000
1	Medium saw frame,	„	6,481·0000
1	Small saw frame,	„	2,232·5000
1	Set shafting, &c.,	„	3,736·0000
		Total, ...	20,371·0000
	Add 10 per cent. for erecting,	... ...	2,037·1000

Tools.

8	Large saw frames, No. 1, actual cost at Madhopoor, ...		99·0000
12	Medium saw frames, No. 2,	„	138·0000
16	Small saw frames, No. 3,	„	148·0000
4	Circular saw frames,	„	270·0000
12	Dozen files,	„	73·0000
		Total, ...	728·0000

Carriage.

259	5	0	Castings from Roorkee to Madhopoor, at Rs. 1-8 per maund,	388·6875
521	7	0	Iron work from Madhopoor to site, at 9 as. per maund, ...	293·1609
850	0	0	Machinery and tools from Madhopoor to site, at 9 as. per maund, ...	478·1250
			Total, ...	1,159·9734
			Add regulator for at the head of the mill channel,	5,073·8059
			Add contingencies at Rs. 5 per cent.	3,169·0000
			Grand Total Rupees, ...	66,542·0000

J. D. Smithe.

Fig. 8: Cost estimate of the machinery from England. (Source: Professional Papers on Indian Engineering, vol. 1, 1863-64).

2.6 The Repercussion of Intersection

Among the repercussions of the exchange and intersection of indigenous and colonial processes of making architecture in the 19th century India, the most important was that it changed the course of processes of construction in the subsequent 20th and 21st century. The exchange of glazing techniques, coloring techniques of terracotta from Europe and its application to local soil, through the Basel Mission priests initiated the mechanization of tile making, changing not just the making but also the manifestation of architectural form. For example, the slope of the roofs started to change, the interlocking systems of the machine made tiles made each element of the building uniform and standardized, hence changing the built landscape of Mangalore and much of South India. The red flat tiles were the new identity of Mangalore. There were other repercussions of precision and standardization that were evident in architectural form from this time onwards, due to precise machine made elements such as terracotta tiles and bricks used in one, standardized size, through the country, normalizing a particular size irrespective of the context.

3. BURNT BRICKS

Knowledge was acquired by British Engineers without acknowledging the workforce many a times in its Indian colony, the masons and the local experts, and by limiting the local practices and forcing skilled labor to work for them through coercion based on taxation and licenses. [10] The literature on the history of 18th- and 19th-century architecture in India until very recently did not engage with the plurality of patronage, expertise and the politics of the empire. It did not include the intermix of architecture of the native masons and European influences because the focus was primarily on the art historical sphere and excluded any mention of the political and patronage-related issues that manifested themselves in architectural technique or form. Sten Nilsson's European Architecture in India 1750-1850 published in 1968 and Splendours of the Raj by Philip Davies published in 1985 are typical examples of the exclusion of Indian patronage which led to a complete ignorance of the intermix of styles, let alone the techniques and technology. Thomas Metcalf (1989) mentions the Indian buildings in an appreciative narrative, but upholds the view that the British 'revived' the Indian architecture. The very idea of the 'revival' of architecture indicates that contemporary Indian architecture was considered inferior to European architecture and that local expertise was non-existent. The theory of decline and European superiority was inherent in the modus operandi of the empire. This percolated right down to the everyday working of engineers and people on site. This fundamentally suppressed Indian expertise, though it was deeply embedded in the construction practices. Even if the expertise was used in construction of monumental and other smaller public buildings, it was rarely acknowledged. Apart from these appropriations there were many instances of overlap of the indigenous and colonial knowledge systems. Some examples of this intersection of the indigenous and colonial practices of construction are elaborated, through buildings built in brick.

3.1. Gola

The examples of this mix of styles are many, but one of the most outstanding and large state-sponsored experiments was John Garstin's Gola, a circular granary built in 1786 on the banks of the river Ganges in Bankipur (Fig 9). [11] This was a brick dome with a radius of 120 feet or 36 meters approximately. It was meant to be a granary but was never used as one. The vaulting techniques, the aesthetic form and knowledge of the making of domes were transferred obscurely from the native mason to Garstin through this experiment. This dome built by John Garstin was one of the biggest commissions by the Military Board. While it served as a granary, it was chiefly built as an experiment and to learn the construction of a large dome. Garstin adapted Indian building techniques in its construction. The Bengal Board was experimenting with vaulting at various sites at this time, such as in the Fort Allighur barracks. [12] This dome represented one of the first endeavors by the British engineers in the 18th century to appropriate the local knowledge of domes and vaults in the name of 'experimentation'. British engineers would use the state's resources to build newer, larger structures

in British India and at the same time appropriating knowledge from the local experts, masons and artisans. These building experiments were commissioned as the British Empire sought to extend its bases especially in the 18th and 19th centuries.

The means of 'experiment' was used to appropriate local knowledge in British commissions where the native masons worked. [12] It was in the mode of 'experimentation' that the British officials, engineers and patrons appropriated the Indian knowledge, through letting the local masons build smaller models or even buildings with specific technical elements of domes, vaults or plasters while they learnt these techniques by watching, appropriating and then applying them elsewhere.

Fig. 9: Gola at Bankipur, Bihar. (Source: https://en.wikipedia.org/wiki/Golghar#/media/File:Patna_-_GolGhar3.JPG, 2020).

3.2. Havilland and His Appropriations

Well foundations were another case of appropriation of native techniques by British engineers. The Madras method of well sinking was recommended by the British engineer de Havilland to be used instead of the pile foundation for the construction of St. Andrew's Kirk in Madras. [13] This was a direct appropriation of a native technique and not a fusion or hybrid as the technique was not changed or modified. The native well sinkers of the region who specialized in this work executed the entire job. While the engineer de Havilland is known as the builder of this church, the native experts do not find sufficient mention for their work, in any other records except a brief, generic mention (without their names) in Havilland's description of the making of the church in 1817. These mechanisms of obliteration by ignoring the identities of the well sinkers and accepting their expertise as their own, was a systematic appropriation of native techniques.

The foundation of St. Andrew's Kirk is made of numerous brick and pottery cylindrical wells. This method of laying foundations was known as the Madras well sinking method. The process involved placing bricks in cylinders to form rings, which were sunk into the ground and firmly bound with ropes made of coconut husk or straw. The brick wells were 1.2 m in diameter and the pottery ones about 1 m (Fig 3). [14] These wells were filled with rubble, brickbats and small stones to provide an infill and stability. The wells were built next to each other forming a series of smaller foundations on which rested the walls of the church. De Havilland recommended this technique even over the pile foundations that were then common in Britain. The technique was embedded in the expertise of the local community, which used local methods of foundations and even local tools such as mammotty (a large tool with a short handled hoe). The men who used this tool were called the 'Momaty Men' by the British engineers. The British military did not just use the local techniques in construction, but abandoned the services of local artisans later by drafting troops of men employed in the army to do repair work and other labor tasks. The social dynamics of the working class were mixing, and the evolving technocrats, like the British military engineer de Havilland, were the propagators of this mix. Nevertheless, the skill and knowledge of well sinkers was used by British engineers in their buildings.

The procedure of sinking the wells needed bricks that were circular. These bricks were utilized to construct the tubular walls in sections. The base of the dug pit was lined with a base ring of wicker-work. The cylindrical wall was elevated to a workable height and the cylinder that was created was tightly bound externally, with straw ropes, from bottom to top. This process was repeated till the rings vanished into the soil. The well was then packed with brick bats, rubble or any other material which would not melt or swell with water and would permit ramming. The wells were placed close to each other and then levelled, over which the masonry foundation was laid. The terracotta wells were fitted up and sunk like the others but they were made with fired earth rings. The plans show that the larger wells were used for the more crucial load-bearing places. The clay mortar used between the bricks was very thin and fine and the wells could be as deep as 50 feet. [14]

Throughout the well-sinking process, the men were almost continuously immersed in water. It was a tough and skilled job as they had to dive and be immersed in water for long durations, while carrying out the work. The practice of allowing the water to rise over the men was to save the expense of bailing, which was a huge amount. It further avoided the water forcing itself from the gaps in the bricks, which would wash away the mortar, if bailing was executed. As it was difficult to work under water, the workers were replaced several times. [12] There are several detailed accounts that show deep respect for the work of the well sinkers at the time. De Havilland had also approved the petition for pension made by the wives of two well sinkers who died during work. The skill and method was of native origin, which was employed to undertake an imperial building. It was the high social position of engineers in imperial India that opened up a chance for them to

peer into the lives of the South Indian skilled experts and workforce. The record of native participation and knowledge in the execution of some tasks is scarce, and that is the reason I initially emphasized that these exchanges were not equal.

With the coming of the British and their desire for opulent imperial spaces, the already existing native knowledge of vaults and domes was deployed in the construction of large halls through the interception of the British engineers. One such was the great banqueting hall at Mysore commissioned by John Malcolm, a political figure. Captain de Havilland, a British engineer in Mysore, who was known for building a great arch with a 100-foot span with country bricks, was invited for Malcolm's project. [16] Mysore was a place for scientific enquiry in the early 19th century, and the aim of the state was to acquire and advance development through scientific knowledge. [12] In this atmosphere, engineers such as de Havilland were key links between native knowledge, European technique and the exchange among them. Patrons like Malcolm wanted domes built by British men who had an extensive knowledge of Indian vaulting techniques.

Mediating between the English patron and native expert was the British engineer. De Havilland, with experiments such as the construction of the hall, acquired knowledge from native builders through smaller experiments. De Havilland's experiment to make the vaults and arches with Indian craftspersons was a means to access the rich body of native knowledge of vaulting techniques through practically watching and learning from them. All these experiments were done in burnt earth bricks. In these processes of experimentation by engineers, local knowledge was passed on to the British domain, many a time unacknowledged, while the Indian side perceived the European ornamentation, Western proportions and volumes.

Another example of a British dome that was built using the intricacies and techniques of native knowledge was the fort church of St. Mary's. The church, in present-day Chennai, has a 5-foot-thick barrel vault roof, made with Indian material and knowledge in 1678. This church has tapered courses at the circular start and then slowly the dome has true arcs near the crown. Another church built around the same time, in 1701, called the Church of Zion at Tranquebar in Tamil Nadu, had a wagon-vaulted roof rising above a very Indian-style parapet, with turrets. [17] This church was the official church of the Danish East India Company. De Havilland built a test dome in the garden on Mount Road before building the famous St. Andrew's Kirk in Madras. This was meant to be a domed building. Lieutenant Grant, acting as Presidency superintending engineer, had agreed on a circular plan with a domed roof based on the unbuilt circular design of St. Martin-in-the-Fields by a famous architect of the time in London, James Gibbs. The original design of Gibbs was to be implemented in Britain as a wood structure covered in metal. De Havilland was called to Madras to execute this church on the ground of his familiarity with dome construction and the region. [12] He persuaded his patrons to alter the material to brick, with which he was more familiar owing to his experiments with the

local masons. The result was the shallow brick masonry dome of St. Andrew's Kirk, with an internal diameter of 51.5 feet, which was built with the native technique and knowledge acquired by the British military engineer de Havilland. The thickness of the dome at the crown was 9 inches and the bottom cornice was 27 inches. This meant the dome tapered towards the crown and it would have been a corbelled construction, just like in the Indian tradition of the domes in Thanjavur. Three courses of flat tiles were laid over the Syrian cones over which stucco was applied. The structure, including the flat roof, the shallow corbelled dome and the 'chunam' finish were all a reflection of the South Indian vaulting techniques. [12] Brick masonry domes were not common in Britain in the 18th century, and even Gibbs's building of St. Martin-in-the-Fields, whose design was conceptually copied for St. Andrew's Kirk, was later built in wood and metal and not brick masonry. [26] What makes it certain that de Havilland's experimental knowledge, gathered from the native builders, was used is that there is no evidence of construction drawings being used, which means the builders sketched onsite and used their inherent knowledge and expertise to make this dome. [15]

3.3. Precarious Details: Colored Bricks, Plasters

Coloured Bricks: Coloured bricks were not in use in India in the 19th century, but the desire and nostalgia of the British engineers for the colored bricks of Britain provoked many experiments in colonial India. The bricks in England ordinarily had a deep red, yellow, or salmon, blue or white color. All these were produced by a careful mix of earths and not by chemical substances. The red was due to the presence of peroxide of iron in the earth, the blue was obtained by application of greater heat to various mixtures of earth and white by a mix of plastic clay and chalk J. G. Medley, a British engineer and also the author of various volumes of the Professional Papers of Indian Engineering, agreed to publish any experiments and findings on the specific matter of colored bricks in the professional journals. The engineer also brought to India specimens of colored bricks, and the raw material from which colored bricks could be made in India. These specimens of bricks and raw material were later used to experiment with Indian earths to make a variety of bricks.

"Some experiments are also being made at Roorkee, and I have succeeded partially in making black bricks, but have not as yet been able to burn them white or yellow; should any of these trials be of sufficient interest to others they shall be duly recorded.". [8] The experimentation to imbibe qualities of British bricks was representative of constant exchange. While the raw material and skills of the Indian masons were used, the techniques of Britain were to be replicated in India.

Indian Plasters and Mortar : Dharampal's (1971) research into the archival records of British engineers in India in the 18th and 19th centuries establishes the sophisticated technological knowledge that prevailed in the Indian subcontinent. In a paper written by the Governor of St. Helena in 1732 reproduced in Dharampal's collection, the mortar produced in Madras in the 18th century is said to be superior to anywhere

else in the world, including plaster of Paris. The engineer elaborates the ingredients used and also the technique of mixing the concoction in great detail. [18] There are two insights that display a strong borrowing and exchange of mortar and plaster making techniques. The first is where the engineer describes the complex and fine mortar which is achieved with this process, and which could be applied as a fine layer between bricks, unlike the English mortar which is thick and rather crude in comparison.

> "Observe also, that the mortar here is not only to be well beaten and mixed together, but also laid very well, and every brick, or piece of brick, slushed in with the mortar, and fievery cranny filled up, yet not in thick joints, like the common English mortar; and also over every course of bricks, some to be thrown on very thin: And where the work hath stood, though but for a breakfast or a dining-time, before you begin again wet it well with this liquor with a ladle, and then lay on your fresh mortar; for this mortar, notwithstanding its being thus wetted, dries much sooner than one not used to it would conceive, but especially in hot weather." Extract from Isaac Pyke, Esq., Governor of St. Helena, published 1732, [quoted in Dharampal 1971, 167-68] [19]

The second instance in the description of the engineer is where he substitutes the ingredients of astringent barks with oaken bark, aloes with turpentine and jaggery with molasses, and instead of toddy, palm wine so that the same plaster could be produced in England. This description is a sign of not just the superior quality of the indigenously produced plaster, but also of the exchange of this knowledge from India to Britain, and not just from Britain to India, the latter being a notion consistently pushed by the British records. Most Britons at the time were unwilling to admit engineering and scientific know-how obtained from Indian experts. This view was prevalent till as late as 1996. [20] While the techniques of making mortars and plasters with lime and other natural ingredients were used consistently in the 19th century, indigenous techniques were used and altered with newer technology and engineering by the British engineers. The technique for creating artificial hydraulic lime, originally from the Treatise of U.S. Engineers and the Treatise on Calcareous Mortars and Cements, was borrowed to create this artificial hydraulic lime. The method, while not novel in principle, was travelling around the world through the military engineers in the mid-19th century to reach India. [21] Further, there was not just an exchange of technique and technology between India and Britain; the use of traditional materials such as jaggery or hemp appeared in the PWD manuals, thus standardizing native processes and techniques into mainstream construction practices. It is important to note here that the Industrial Revolution took center stage in the 19th century, and the technological development in the construction industry, like in other sectors, was rapid. The mortars, bricks, plasters and various such construction materials and the processes of making them industrially were replacing the handmade techniques. The industrial production was quick and economically much more viable in the 19th century,

replacing even the best of material. Cement and steel replaced lime and brick, and slowly but steadily the traditional, vernacular techniques and materials disappeared.

4. CONCLUSION

The numerous cases elaborated in the paper argue for a closer reading of architectural 'making' of 19th century construction, that includes the contributions of the unknown craftspersons, artists and masons that built in the 19th century. There was a definite rupture that the colonial arrival made to the indigenous practices of construction in the Indian sub-continent but what is rather interesting is that it had a large repercussion on the processes of construction in the subsequent centuries, in the processes of construction. The contextual understanding of the built form had given way to a standardized system of working, where precision and uniformity were regarded as high virtues, without really understanding its need. The disconnect of the hand to the making, devalued the skills of larger communities that understood a context, while centralized, standardized processing was affirmed as sophisticated qualities. This appropriation of knowledge from the indigenous, without sufficient acknowledgement and a complex transition from hand made to machine made let to a highly colonial reading of the history of architecture of South India. I argue that a decolonial reading of these architectural productions is necessary to understand 'making' of architecture in formally colonial lands, in a newer, much more equitable perspective in the current scholarship of architectural history.

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THE ENTANGLEMENT BETWEEN TRADITIONS AND THE COLONIAL SPATIALITY. THE RESILIENCE OF THE GUINEAN DOMESTICITIES IN THE AJUDA NEIGHBOURHOOD, BISSAU.

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Traditions have always been endangered by colonialism and modernity. They were exploited for colonial purposes and even subverted by them[1]. They were reinvented under both modern and imperial discourses[2]. Nevertheless, new traditions also emerged from both colonial and modern legacies[3]. Examining the Ajuda neighborhood, built in the capital city of Bissau to accommodate mainly public officers and their families from the African population, this paper aims to unveil how Guinean traditions related to the dwelling space, the house, have been reorganized within the colonial spatiality, shaping and transforming today domestic environment. Using the house as a critical tool, this paper will discuss how traditions endure as long as they are negotiated by new factors that may derive from disruptive events, such as colonialism.

1. INTRODUCTION

Guinea-Bissau is a small country of West Africa and constitutes a *par excellence* case study to deepen into the topic of rupture and tradition(s). Located in the precolonial region called Senegambia[4] at the crossroads of cultures – nomadic and sedentary, animistic and Islamic –, Guinea-Bissau history has been marked by the convergence of different disruptive forces – immigrations and invasions, slave trade, colonialism and wars – that throughout the centuries provoked processes of transformations, rupture with traditions, and negotiation of a diverse range of Guinean culture[5].

Out of the major events that shook Guinea-Bissau history, colonialism is the one which transformed deeply traditional Guinean domesticities. On one hand, it forced directly on people to adopt a different way of life which still echo in today habits and practices. On the other hand, it introduced indirectly new referential dwelling models. Because of this, the House in Guinea-Bissau constitutes a privileged field of study to explore the entanglement between colonial spatiality and Guinean traditions.

In the search for counter-domesticities within the colonial spatiality, the idea of *photographic development* – the process of revealing a latent image into a visible one – was a very useful tool. In order to make the entanglement between colonial and contemporary domesticity visible, it was fashioned a revealing method that served the purpose. Firstly, by transferring the colonial house-type contours from a paper to a notebook by carbon-copy technique, then, by revealing appropriation processes that occurred within the space. The blue lines corresponding to the colonial house-type contours were impressed on the notebook, fixing the colonial constrictions that the house-type imposed. Subsequently, the usage of the domestic space, the stratification of changes occurred in the house, the multiple uses of the compartments, the traditional vocabulary emerged, being recorded by a green pen on the notebook.

Fig. 1 : Carbon-copy paper sheet by which several colonial house-types have been transferred from the paper to the notebook. (Source: picture by the author).

During the late decades of Portuguese colonization in Africa (1920s-1974), native traditions have been exploited for colonial purposes with the aim to categorize the colonial society into "indigenous" and "non indigenous", who benefited from different rights. The "Political, Civil and Criminal Act of the indigenous of Guinea, Angola and Mozambique colonies" (1929) defined that "indigenous" people comprised all the individuals belonging, or descending, to the African population that, by their appearance and customs, did not differ from their kin. "Non indigenous" included all the others who did not belong to the previous group[6]. To aim for this segregation of the population, it was crucial for the colonial administration to "decode" and "categorize" the customs and the habits of the African population, labelled as "indigenous". In Guinea-Bissau, as in Mozambique and Angola, the African society and culture(s) was mostly unknown to the central colonial apparatus based in Lisbon. To give a dimension of the urgency to unpack the specificities of both native populations and the country itself, in 1935, Marcello Caetano, the Ministry of Colonies (in charge between 1944-1947), encouraged a "new discovery" of Guinea-Bissau: he evoked the importance of territorial "scientific occupation" aimed to "unveil the Nature in order to subdue it, to describe the man in order to improve him and to assess the economically usable resources so that greater wealth may be produced"[7]. However, even before Marcello Caetano statements, Guinea-Bissau ethnographic surveys of 1918 and 1927 reveals the intention by the occupying authorities to elaborate the Penal Code for native population as well as

to ensure a "better knowledge of the native populations by the administrative authorities in order to promote their development"[8]. In those mid-century years Guinean traditions, especially those concerning the settlement (geographical and architectural speaking), the means of subsistence, the societal organization (with special interest to the traditional chiefs) and the religion, started to be collected and decoded, used and abused for colonial purposes until Guinea independence (1974)[9].

2. TRADITION DISRUPTIONS IN GUINEA-BISSAU: AN HISTORICAL ISSUE

In the peculiar case of Guinea-Bissau, the House has always been the tool to decipher the impact of traditions negotiation, and the place where traditions negotiation most occurred, and where they were most visible.

From the XVIth to XVIIIth century along the Guinean coast, the house became an important symbol of self-identification, which borrowed features both from native architecture and from Portuguese ones. In fact, during the mercantile period of colonization it was important to be identified as "Portuguese", because it grated the privileged social status to trade along the Senegambia coast. However, the Portuguese identity was not related with nationality. On the contrary, being identified as "Portuguese" was associated with a range of features such as the catholic religion, the occupation as trader, the spoken language (Creole) and the *peculiar characteristics of the house*[10]. The house *à la portugaise*, as it was known, was the building associated to the people pointed out as "Portuguese". It was a one-floor dried-earth construction with a rectangular shape, plastered with clay or lime to give an outer whitewashed effect and characterized by the presence of a welcoming vestibule and/or by a veranda. This peculiar domestic architecture was the result of traditions negotiation through the "interaction between local construction techniques and building forms, and materials and techniques brought to West Africa from Europe"[11]. This dwelling model was created by Luso-Africans traders, but it was also appropriated by local merchants and leaders for the social status it provided. The *maison à la portugaise* can be considered an elucidative example of how processes of traditions resilience, negotiation and transformation within the domestic space have always characterized the DNA of Guinea-Bissau. The endurance of this dwelling mixed tradition is reported in the survey on Bissau built environment, conducted by José Antonio Guardiola (1945). Throughout his report, the author condemned the promiscuous and precarious living conditions of the Portuguese servants, referring to the domestic space which was in reality, the *maison à la portugaise*. The dwelling model of the *maison à la portugaise* which characterized for many centuries the housing tradition of Luso-Africans in Guinea-Bissau became obsolete with the insurgency of a different colonial policy. A more *rational*, *salubrious* and *clean* domesticity based on modern and hygienic ideals typical of the XXth century would have been introduced by the colonial State, molding the dwelling tradition in Bissau.

As anticipated, the House in Guinea-Bissau also represented a tool to assess the occurrence of traditions negotiation between the European and African culture. Great attention to traditions contact was given by the colonial state starting from the decade of 1930, when the House became a political tool to assess differences between the native and the European society. In 1933 the Colonial Act (Acto Colonial), which condensed the Portuguese colonial policy in foreign countries, was integrated into the Portuguese Constitution ruling one of the fundamental of the Portuguese colonization: the *civilizing mission*. The idea that colonialism was an agent of transformation and social "elevation" of the native population was particularly intrinsic into Portuguese colonial discourse until the time of the independences. In this ideological frame, the dwelling played a crucial role. In many architectural speeches and texts about housing projects for native population, it is common to find the idea that "in contact with the European civilization, the indigenous people would achieve a civilized mentality and habits"[12], and that, it was "up to the European to create into indigenous people the need for comfort and a higher standard of living"[13]. Housing projects for native populations would have served efficiently to this purpose.

Under the fever of the *civilizing mission*, scientific expeditions served the scope to find evidences of the assimilation process, unveiling how the native way of life adjusted and was reconfigured by the contact with the European culture. The dwelling realm became the space to measure this process.

Avelino Teixeira da Mota, a military hired as field assistant by the Governor Sarmento Rodrigues (1945-1947), became the personality responsible for the cultural production in Guinea-Bissau and for a diverse range of surveys related to native settlements[14]. In the seminal book "Indigenous house in Portuguese Guinea" (1948), several pages are dedicated to the topic of Guinean traditions disruption within the domestic space due to the contact with the Portuguese colonization and the European culture, similar concepts could be found in another book "Classification and evolution of the native dwelling and settlement" (1948) by the same author. One of the examples that better illustrated the tradition disruption caused by the contact with colonialism, was represented by the disappearance of the traditional Manjaco patio-houses characterized by multiple rooms facing an interior courtyard. As Teixeira da Mota reported, due to the tax of *imposto da palhota* (*palhota*= native house with thatched roof) that native people were obliged to pay to the colonial administration according to the number of houses and beds, Manjaco native groups started to simplify their ancestral houses and settlements to reduce the amount of taxes to be paid to the colonial administration[15]. Even if this case of tradition rupture was pointed as negative by Teixeira da Mota himself, other examples of traditions negotiation within the domestic space from the contact with European culture were described in a positive way. The custom of using interior furniture (chairs, iron beds, tables, chests, etc.), based on western dwelling traditions, the usage of mosquito nets or the decoration of the interior of the house by hanging

propaganda pamphlets, portrait images cut out from newspapers, old and new calendars: symbols of western civilization, were all considered positive traditions negotiation brought by the European way of life.

If the colonial times were characterized by the obsession of cultural contacts between European and African population, by either avoiding them or fomenting them for "civilizing" purposes", this article will not focus on cultural *metissage* within the domestic space, but it aims to unveil the *contre-types* of dwelling practices that arose from the colonial house-type constriction as an expression of Guinean traditions resilience[16]. To achieve this, I select the neighborhood of Ajuda in Bissau, built during the colonial rule in 1965 with the purpose to accommodate mainly public officers and their families from the African population.

3. THE AJUDA NEIGHBORHOOD

The Ajuda neighborhood was built during the Liberation War (1963-1973/74), in the outskirts of the city of Bissau, about 6 km from the city center; however, the intent for its construction is very blurred and almost mythical according to both oral history and archival documents. It seems that it was meant to accommodate people in needs who suffered from a fire occurred in one of the native areas in the center of Bissau. In fact, *ajuda* in Portuguese means help, assistance. However, only a small percentage of the people living in that neighborhood belonged to the affected population; while the majority was public officers (nurses, agronomists, office workers, etc.) and their families belonging to the African population.

Fig. 2 : The construction of the Ajuda neighborhood, aerial view (1965-1966). (Source: image courtesy Prof. Sandra Mula).

By field research and reading "against the grain"[17] the archival materials, I could perceive that the construction of Ajuda neighborhood could have served the purposes of the "demagogic policy"[18], implemented by the colonial state during the Liberation war, under which many propaganda tools were used in order to gain the support among the local African population. The construction of a "model neighborhood" for African people could have fit perfectly this purpose. In fact, the Ajuda embodied, and it still does, the label of an exemplary neighborhood. Nowadays people in Bissau refer to the Ajuda as an "urbanized" neighborhood, where "people are educated" and "know how to behave". This 'way to behave' is not easy to reckon, as it is more related to a "performance" within the public and private space of the neighborhood[19]. The "formalities" or "customs", terms used by the Ajuda neighborhood residents, are rooted in colonial times and have perpetuated in the inhabitancy of public and private space.

At the time of Portuguese colonization, the Ajuda residents were forced to behave in a certain way, especially for what concerned the domestic practices. Homes had to be tied, gardens cleaned and well kept, beds properly done, meals had to be consumed with cutlery and on a table and children suitably dressed, especially with their shoes on. The interior and the exterior of the house had to be kept neat. It was likely that the disobedience of the colonial rules, caused the exclusion of the family from the neighborhood[20]. Recurring patrols by the colonial administration were organized in order to monitor how people behaved and if they followed the rules of conduct. The "cleanest family" was rewarded with amenities such as blankets or bed sheets, and as today reported by the residents: everyone aimed to be the cleanest family.

The Ajuda's families lived in very basic houses. The colonial house-type was designed in a rectangular plan where a central corridor organized 3-bedroom and the living room. Service facilities and the kitchen were located in the outer space of the backward veranda and a private garden surrounded the house. The neighborhood was built according to a grid planning, where houses were all oriented in the same way, facing the main street and being separated by low hedges. During the colonial period the houses could not be modified by their occupants, but instead the space, how the house was organized, had a strong influence on how people adapted their life to this new dwelling space.

After the independence (1974) emancipatory processes started and traditional domesticities began to (re)emerge from the interstices of the colonial spatiality, reshaping spaces and redefining ancient traditions. Families started to rejoin, to grow again and to reorganize themselves according to Guinean traditional kinship, while during the colonial period and especially during the war people movements were very restricted and controlled. Free to inhabit the house as they finally wish, the Ajuda's residents have been transforming the domestic space in multiple ways which was the expression of new Guinean traditions of dwelling in that specific context. In fact, through the process of War and after the independence, Guineans as the Algerians,

became free to adopt, to transform, to hybridize European tradition with their owns. Finally, "any innovation introduced by the West can be adopted without its acceptance being considered as an expression of allegiance"[21].

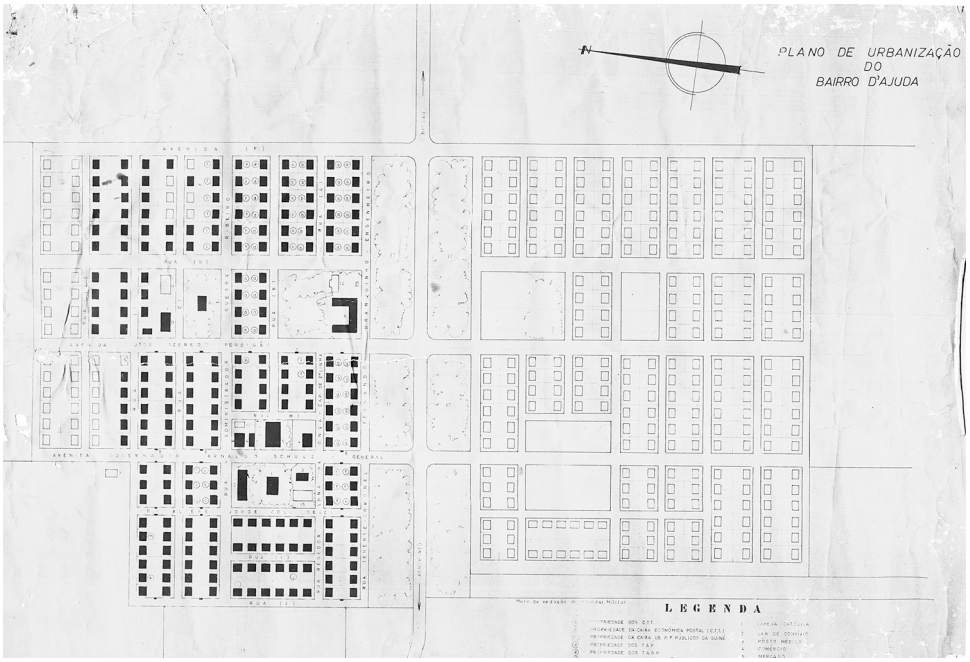

Fig. 3 : The Ajuda neighborhood's plan (first phase on the left, second phase on the right) 1965. (Source: Ajuda sporting club, Bissau).

The process of traditions resilience within the houses of the Ajuda neighborhood had happened slowly and the traces of the carving process of a new domestic spatiality are the result of the tensions between European and African traditions and they can be observed both in the physical space and in the daily practices within it. For example, the addition of new rooms and attachments to corresponded to daily practices based on traditional Guinean rural way of life; the reverential usage of original compartments, like the dining room, or the maintenance of the original street façade also reflect that entanglement of traditions. The intertwine of Guinean and European domestic references is well express also in the multiplication of some domestic functions, for example the kitchen and the dining room.

4. THE ENTANGLEMENT BETWEEN TRADITIONS AND THE COLONIAL SPATIALITY

In the Ajuda neighborhood, the house-unit which once characterized the colonial setting has been expanded and fragmented into a more complex dwelling landscape which intertwines public and private, indoor and outdoor spaces to accommodate the typical multinuclear Guinean family. The multiplication of the dwelling space is not visible from the street, but it is revealed to the observer only when the central corridor, that links

the front and the back facades, is crossed. A strong polarization between the front and the back facades, between what is visible from the exterior and what must be protected in the interior, characterized the contemporary house in the Ajuda. While the street façade in most cases is kept as the original, denoting a certain will to conform to the collective "image" of the neighborhood, the back facade underwent a process of radical transformation. In fact, the main house-unit grew from the interior, occupying the perimetral veranda, with the exception of the street façade. The extension of the house in the backside veranda originated new rooms connected with the outdoor patio. The generous dimension of the colonial parcel allowed the families to expand the house towards the back side, and to add new constructions in what previously corresponded to the backyard garden. The added attachments, in most cases rooms for the young male members of the family, provided the house with new domestic areas for a family which comprised on average 10 people. Those attached spaces together with the main unit created a central patio where a wide range of collective function take place: washing and preparing raw materials, cooking, cleaning, drying laundry, etc.

Fig. 4 : Courtyard view of a house in the Ajuda neighborhood. (Source: picture by the author)

The vibrant organization which takes place in the backyard of the plot is the adaptation of the traditional settlement unit called in Creole, *morança*, which was confined within an urban and limited space. This term – whose root comes from the term *morar*, to inhabit \– is the given name to the traditional settlement of a Guinean family in rural areas. Each family nucleus, *morança,* is where the enlarge family lives and it is

characterized by numerous houses built closer together or more distanced, whose voids are filled with collective functions and communal spaces. The *moranças* can be fenced or not, and together with the others family-nucleus constitute a village. The resilience of this peculiar traditional settlement, can be found in the backyards of the Ajuda houses, but it is also very common in others parts of the city, and it has been reported or studied by few scholars[22]. Unfortunately, this peculiar traditional way of families joining together in small clusters within the urban fabric is insufficiently studied, however it could represent an original and interesting planning tool to redesign the city engaging with the residents, as it embodies a spontaneous urban spatiality based on the importance of community living, low density and green spaces.

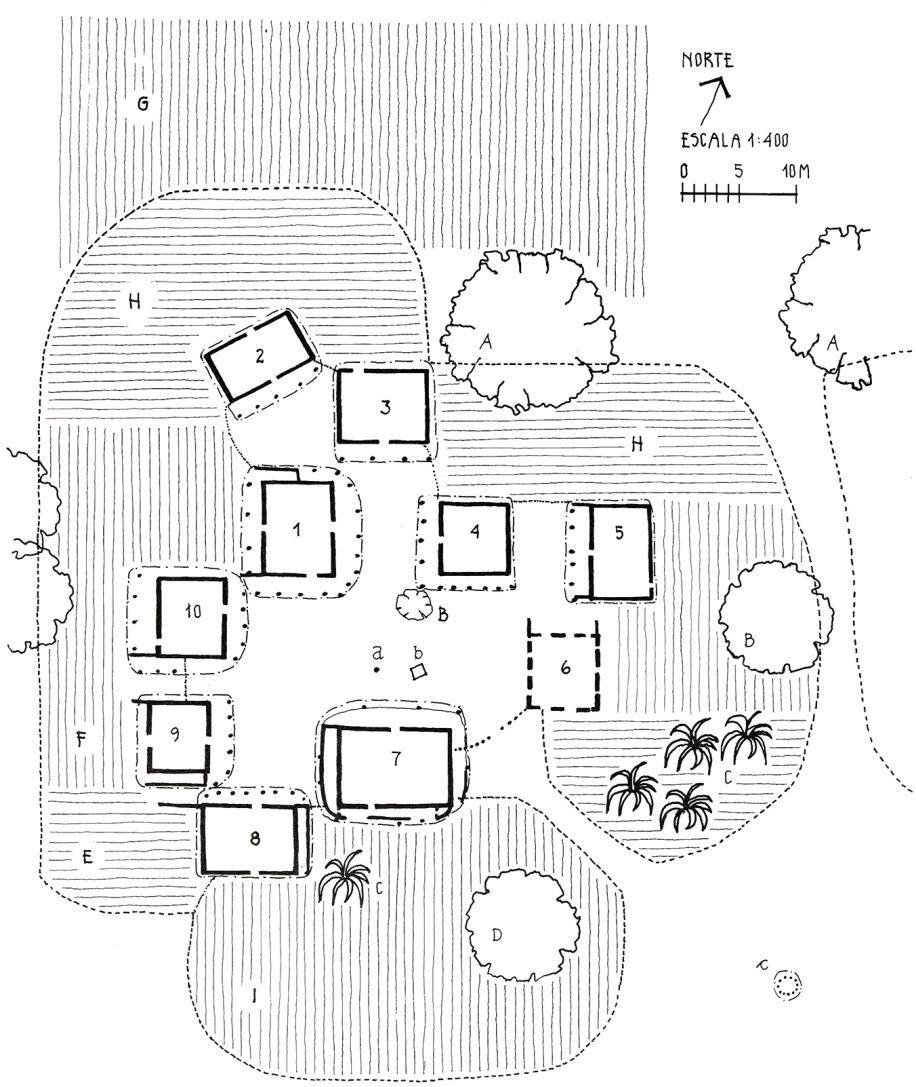

Fig. 5 : Traditional *morança* from the Balanta ethnic group in Quinara Region in Southern Guinea-Bissau. (Source: Blazejewicz, et. al, 1983)

The peculiar dwelling organization implemented by the Guinean families according to rural traditions might constitute a phenomenon which already existed during the colonial times. In the sixties, the dwelling emergency in the urban area, aggravated by the Liberation war, triggered an interesting range of urban studies in order to find solutions to release the demographic pressure on urban environment. Bissau, contrary to Luanda or Maputo which were characterized by informal high-density neighborhoods, presented an urban densification below the ONU standard for African cities[23]. According to the author of the "Study on Bissau habitat", it was possible to "achieve higher population density" without implementing any housing programs that involved the displacement of the residents[24], a recurrent practice during colonial times. The low-density environment which characterized most of the neighborhoods in Bissau, as reported by the author, probably resulted from the organization according to traditional family-unit, which privileged common outer space where most of the daily domestic practice took place.

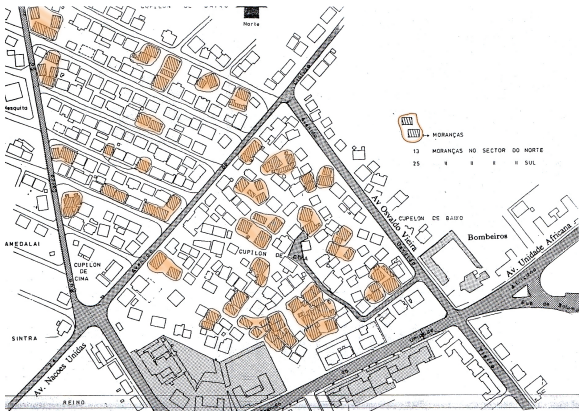

Fig. 7 : Fig. 4 – Traditional *morança* setting in central area of Bissau, surveyed by Claudio Accioly, 1993. (Source: Accioly, 1993)

Fig. 6 : Communal space within houses in the Bissau informal neighborhood of Antula, 1988. (Source: courtesy of Prof. Manuel Fernandes de Sá)

In the search for *contre-types*[25] of dwelling practices in the Ajuda neighborhood, the habits around meals preparation and consumption constitute an interesting subject to ponder about traditions endurance. First of all, the "kitchen" which in the Guinean traditional rural settlement, is a scattered area around the house or a space in the veranda, where different actions take place: the preparation of raw materials, the cooking, the washing, the food conservation etc. For my study, we need to take distance from the idea that the kitchen is a solo-compartment where every action of meal preparation takes place. The modern kitchen we are used to, where all the functions are concentrated in a *unicum* space and sometimes furniture, is indeed a recent domestic innovation even for Europe.

In the Ajuda's houses, the space of the kitchen is fragmented into multiple places according to the elementary functions of preserve, wash, cut and cook the raw materials. Similarly, as it happens in the traditional houses.

However, the location of the "kitchen" within the domestic space and its organization is strictly related to the fuel used for the preparation of the meal, to the dishes cooked and the ingredients available. Additionally, the meal preparation, the place where it occurs, the equipment used and the fuel needed for its purpose, depend also on the time of the day and sometimes on the season. Many factors influence the space for meal preparation in Ajuda's houses, but the most relevant one is the type of the dish consumed. Even if in the European modern cooking tradition, we neglected that every bunch of ingredients for a dish need different cooking methods, in Ajuda's houses is undeniable how dishes influence the cooking method and consequently the place where it occurs and the tools used. To this end, in order to correspond to both traditional and modern diet, in the most cases the kitchen is split between an interior and an exterior space with different purposes, objects and tools.

The exterior space is equipped with small charcoal grills, called *fogareiro* (from *fogo* = fire) laying on the floor or on a base. The western kitchen counter is substituted by small tables that can be easily moved according to the need. A variety of objects and tools are scattered on the tables, but in most of the cases they are stored in a small room inside the house, which corresponded to the colonial compartment for the kitchen. This exterior space for meal preparation is recognizable, not only for the presence of the grills, but because it is accurately covered by a roof, to let the smoke naturally escape, and it is always located close to a water exit. Sometimes, the exterior space of the kitchen can also fill the space of the backside veranda. The dishes cooked in the outdoor kitchen are the ones of the Guinean tradition, based on rice and grilled vegetables or meat, mostly fishes.

On the contrary, the interior "kitchen" is marked out by the presence of the gas stove, which can occupy different places inside the house: from the original indoor kitchen inherited by the colonial house-type to the living room or the veranda. The gas stove is used mainly for warming up the dinner, the daily left-overs, or to heat up a soup. It is also used to put together a quick breakfast, to heat the milk for the children and occasionally to make a cake. Even if some people justify the scarce use of the gas stove because of economic reasons, others told me that the cost of a bottle of gas is competitive to a sack of charcoal. Of course, the gas stove kitchen I have found in the Ajuda's houses is not very efficient and it lacks for example the automatic smoke extraction; however, the reason why families did not abandon the charcoal kitchen could relate to the resilience of cooking traditional and Guinean dishes. The example of the kitchen space in the Ajuda neighborhood unveils how contemporary and traditional Guinean practices coexist and complement themselves during the daily practice, which are new and reconfigured by the encounter of dwelling cultures.

If the kitchen usage is an example of coexistence and resilience between different cultural practices, the dining room reveals the tension between the colonial legacy and a new Guinean dwelling tradition. The former has

been the territory where the Guinean traditions (re)emerge from the constraints of the colonial spatiality coexisting with new habits adopted from the contact with foreign cultures; the latter is not.

Fig. 8 : Small dining room 'saleta' in one of the Ajuda's houses visited (Source: pictures by the author)

In many of the Ajuda's houses the dining room is doubled in two well defined rooms: the "formal" dining room and the "small" dining room, called *saleta* (small room). The "small" dining room, is located in the backside of the house, usually in one of the spaces resulted from the expansion of the veranda. This dining room is a bright and informal space, linked to the garden in the backyard of the house and to the kitchen(s). Not much attention is given to decoration and furniture of this room: sometimes some chairs of the dining table are missing and in other cases the evidence of a dining room is simply given by the presence of a table covered with a tablecloth. Nonetheless, it seems a very flexible and functional space, used both for dining, for staying, for kids doing their homework and for gathering in adverse weather conditions.

The formal dining room instead is "curiously" located in the original division of the colonial plan, being equipped with formal pieces of furniture and items: laced tablecloths, glasses and crockery cabinets, centerpieces, 4 to 6 chairs, framed family photos, etc. The static nature of the room gives a sense of formality to the space, suggesting that there is a family who gathers during the main meals of the day and who consumes their meals according to rituals and tools based on European practices. As a matter of fact, that family does not correspond to Guinean families inhabiting the houses in the Ajuda. The Guinean families in the Ajuda, are larger families and they do not have the Portuguese habit to gather all the members during the daily meals. The routine of the different members of the family is not synchronized. Everyone, from the

adults to the children, follows his/her own routine, rarely meeting up for mealtime. Additionally, while in Portugal the favored family mealtime is the suppertime, the sacred moment when all the family members gather after the long day of work, in Guinea-Bissau the main meal is the lunch. The lunch is usually cooked in the morning, by a servant or by some members of the family, usually women. Once it is prepared, the meal is consumed during the day according to each one's routine. The Guinean family gathers only occasionally or during festivities, and rarely the gathering happens in the formal dining room, which is too small for accommodating the whole family. In the Guinean tradition, the meal is consumed by hand from a common bowl in small groups, sitting on the floor or on little benches and usually outdoor.

Fig. 9 : Formal dining room in one of the Ajuda's houses visited (Source: picture by the author)

Even for the meal ritual, Guinean traditions found their way to seize the domestic space, overcoming the rigid categorization of functional rooms typical of the European culture. Lunch is consumed during the day in different places and by different members in an unsynchronized way. Dinner is not a relevant meal and it is quickly warm up in the gas stove and commonly consumed in each one own bedroom. Even if, Guinean habits subvert the modern notion of rooms specialization, Guinean families living in the Ajuda adopted and maintained, in most cases, the formal dining room according to its symbolic significance inherited by the Portuguese colonization. Under the colonial rule, the Ajuda's residents were forced to adopt European domestic practices including the use of a dining table, chairs, cutlery and dishware.

5. CONCLUSION

The analysis of the colonial legacy, embodied in the history of the Ajuda neighborhood, reveals the way colonialism operated at a deep level transforming the way of life, the habits and the environment of the Guinean inhabitants to whom "exemplary" neighborhoods, houses-type and ways of life were addressed. By forcing Guinean people to inhabit the public and private space accordingly to the western patterns, the Ajuda neighborhood was subject to this violent process over only 10 years, colonialism left tangible and intangible marks until these days' societies. However, when the country was freed and the independence conquered, the Ajuda neighborhood underwent a process of transformation, and in a certain way of liberation.

The revealing process overlapped stories, unmasked common senses for what concerned domestic practices, challenged the notion of domestic functions according to the western point of view and revealed that tradition is a much more dynamic, resilient and fluid category than what the colonial, modern and contemporary world asked us to believe. However, it has been said that "no space disappears completely, annihilated without trace" and "each addition uses and modifies what preceded it"[26] which is well represented by the dwelling case of the Ajuda neighborhood. The behaviors to which people were forced during the colonial times, engraved in the physical and mental space, continue to influence both the spatial practices that take place and the imaginary produced inside and outside the neighborhood. The residents are very proud to live in the Ajuda neighborhood and they admit there is a "peculiar way to be" among the people from this place. According to the people belonging to others neighborhoods in Bissau, the Ajuda neighborhood is seen an elitist district, where "people know their way to behave".

The study of the Ajuda neighborhood, through the dialogue with the dwellers, the revealing process by copying and redrawing domestic practices, the photographic surveys and the first-hand observation, unearthed that research into heritage, domestic practices and tradition should be approach by trying to not

"speak about", but to "speak nearby" the reality as it is[27]. Which is fragile and complex, especially in relation to colonial legacy.

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[4] Senegambia was a region in West Africa located between the Sahara Desert and the tropical zone, extended from the northern Gambia river to the southern Geba river, which flows in Bissau. Nowadays Guinea-Bissau borders with Senegal to the north and Guinea (Conakry) to the south.

[5] The most known evidence of traditions negotiation in Guinea-Bissau may consists by the creole idiom, resulted from a long process of *metissage* between local languages and foreign ones. On this topic see: Almeida, Miguel Vale de. "Portuguese Colonialism and Creolization." In *Creolization: History, Ethnography, Theory* edited by Stewart Charles. Walnut Creek, CA: Left Coast Press, 2007.

[6] Decree n. 16.473 of the 6th of February, 1929, also known as the "Political, civil and criminal Act of the Indigenous of Guinea, Angola and Mozambique".

[7] Caetano, Marcello. "Uma crónica nova da Conquista da Guiné." (A new chronicle of the Guinea conquest) *Boletim Cultural da Guiné Portuguesa* 1 (1946). p.2.

[8] Mota, Avelino Teixeira Da. *Inquérito Etnografico.* Publicação Comemorativa Do V Centenário Da Descoberta Da Guiné Bissau: Centro de Estudos da Guiné Portuguesa, 1947. p.7.

[9] The author is currently working on a research on this issue that may result in the article "*Between coding and decoding. Inquiring on the late colonial need for surveying the native settlements in Guinea-Bissau*", to be presented in SAH Conference, Montreal, 2023.

[10] Mark, Peter. *"Portuguese" Style and Luso-African Identity: Precolonial Senegambia, Sixteenth-Nineteenth Centuries*. Bloomington: Indiana University Press, 2002.

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[12] Gonçalves Machado, Eurico. *The Native house in Angola. Subsidies for a study of the problem*, 1952. p.2.

[13] Vieira da Costa, Vasco. *Luanda plano para a cidade satélite nº 3*. Porto: ESBAP, 1948. p.26.

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[15] "The shape of the dwelling used to be circular, but as a house of this type always had more than two rooms, the manjacos of Caió began to notice that the collection of the indigenous tax was applied on the greater or lesser number of rooms, hence this type fell into total disuse and was replaced by the rectangular one". (Meireles in Mota, 1948:293)

[16] Pinson, Daniel. *Modèles D'habitat Et Contre-Types Domestiques Au Maroc.* Tours: URBAMA, Université de Tours, 1992.

[17] Stoler, Ann Laura. *Along the Archival Grain. Epistemic Anxieties and Colonial Common Sense.* Princeton: Princeton University Press, 2009.

[18] Lopes, Carlos. *Etnia, Stato E Rapporti Di Potere in Guine-Bissau.* Bolonha: GVC, 1984. p.32.

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[20] This practice was common in colonial times and in Guinea-Bissau have been already implemented in Santa Luzia neighborhood, built in the 40s, to accommodate "people in the process of assimilation of European habits".

[21] Bourdieu, Pierre. *The Algerians.* Boston: Bacon Press, 1961. p.158.

[22] Reported in the sudy: Acioly, Claudio. *Planejamento Urbano, Habitação E Autoconstrução: Experiências Com Urbanização De Bairros Na Guiné-Bissau.* Delft: Technische Universiteit Delft, 1993. Evidences of this typical dwelling organization can be traced in the photographic survey to Bissau by the urbanist Manuel Fernandes de Sá.

[23] The ONU's report "*L'habitat en Afrique*" is cited by the author of the "Study on Bissau habitat". United Nations. *L'habitat en Afrique. (196?).*

[24] Chichorro, Martim Afonso de Sousa. *Estudo Sobre O Habitat De Bissau.* (1968).

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ADAPTATION PATTERNS ON TRADITIONAL HOUSES EXTENSIONS: A CASE STUDY FROM TOBA BATAK HOUSES

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ADAPTATION PATTERNS ON TRADITIONAL HOUSES EXTENSIONS
A CASE STUDY FROM TOBA BATAK HOUSES

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Discussions on this study evaluate extensions to existing traditional houses by employing computational tools for assessment. The complexity and multi-dimensionality of traditional houses demand multiple standing points for review. By treating traditional houses as transformations and contextual adaptions, analysis of the original as a point of departure and additions as new forms of adaptations revealed adaptational patterns providing insights for future developments faithful to the original purpose. Both products of transformations will be dissected in their social configurations, cultural structure in customary use of space, characteristics of their environmental adaptation performance, and economic viability. Assessments employed graphs, space syntax analysis, and 3D models for simulations. In addition, we also observed and mapped the physical relationship between the old and new, along with their shape transformations. The emerging patterns hinted at what traditions have survived, transformed, compromised, or even abandoned as they enter a new cycle of adaptations.

1. INTRODUCTION

Extensions to traditional houses present a form of the built environment as community-developed adaptations. These additions may foretell direction for continuity of the originals when constructed as a contemporary of an adaptational cycle. Extensions form a part of transformational patterns compared to the sources' existing, handed-down practices. What conditions are changing, and what is society's countermeasure to such change? How are their previous inherited attempts to adjust present conditions still relevant? Assessments to read patterns of a community's current attitude towards change may shed some clues.

Our study examines emerging patterns using primarily computational tools. By transforming house plans and shapes into graphs, one is given a form of representation where we can highlight repeated practice. And through the creation of a digital replica in a three-dimensional model, we may measure a house for its climatic adaptation performance. As a mathematical representation, the graph theory allows for parallel comparisons between original dwellings and extensions. We used justified plan graphs and directed graph networks to amplify the often-intangible social structure and cultural hierarchy within a traditional home. Houses that may exhibit differently can be objectively compared with a proper representation.

We put case study houses from our fieldwork to evaluate patterns in their social structure as shown in the configurations of their houses. The modelled houses undergo simulations to see how they deal with climatic challenges in overcoming heat, humidity, floods, and strong winds. Next, we also performed a general cost valuation of both originals and extensions in the present market to perceive their reliability. As for their physical modifications, we recorded the transformation of mass additions over stages. We also looked at

their connection details and any available changes. For all of our investigation, we look for patterns of transformations for each parameter, charting characteristic continuity, deviation, or reformations

Computational modelling generating plans, elevations, and digital models, were produced alongside space use diaries, inhabitant's logbooks denoting their activity and use of space. By employing extensive computational methodologies on their economic viability, social structure, cultural significance, and building performances, the study of patterns of extensions of traditional dwellings presents a referential framework for future design or retrofit of a particular home belonging to a specific social group.

1.1 The Case for Extensions of Toba Batak Houses

We conducted our assessments based on fieldwork documenting *Ruma Bona*, the traditional houses of Toba Batak people, and their extensions at the Samosir and Toba Samosir regions in North Sumatra, Indonesia, recorded in 2020-2021. Houses of Toba Batak people, the *Ruma bolon*, also known as *Jabu bolon* or *Bagas bolon*, have been documented since the Dutch colonization of Sumatera, specifically North Sumatera in the Toba region in the 1890s. An early and perhaps most comprehensive documentation from that timeline is reported by D.W.N. De Boer *"Het Toba Batakssche-Huis"* for the Dutch's Office of Administrative Affairs of the Outer Regions. From there, either a non-Indonesian observer [1], several Indonesian researchers [2], or official reports from The Republic of Indonesian government's agencies [3], compiled notes on the houses gave us an overview of its variational changes and additions over time as background before our field trip in Toba in 2021. (Fig.1)

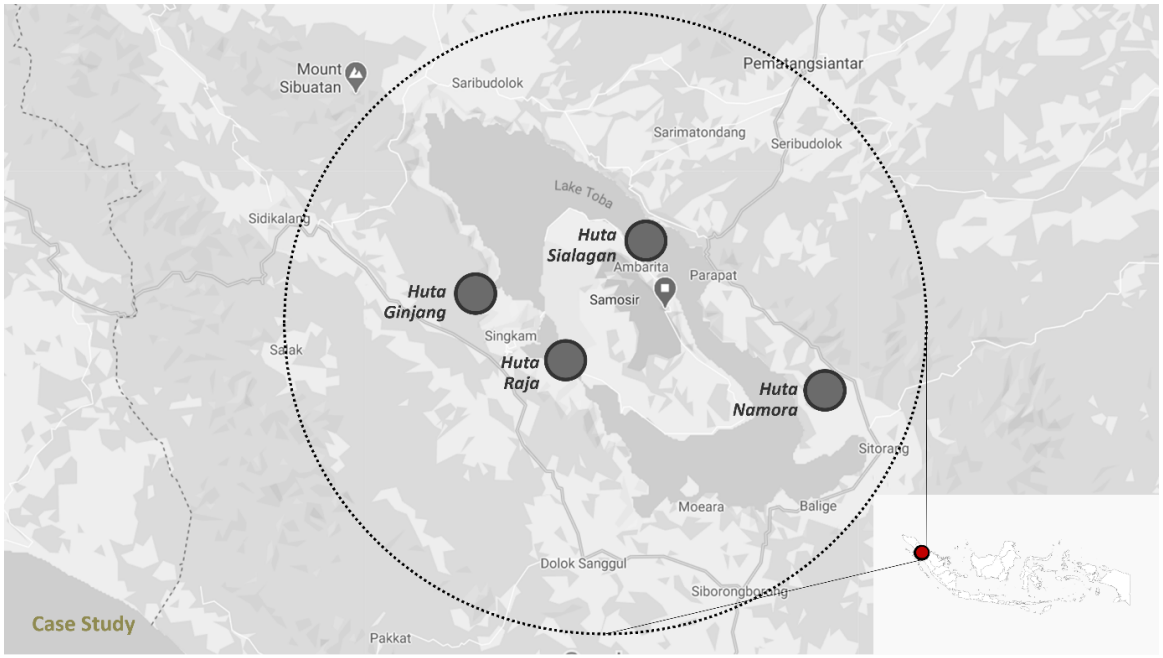


Fig. 1: Area of study, Toba Batak villages (*huta*) in North Sumatra, Indonesia.

The Toba caldera region receives growing interest after being put on a priority tourism development list by the Indonesian government. Later in 2020, The Toba Caldera was chosen as one of UNESCO's Global Geopark (UGG). Many of the traditional *huta* of the Toba Batak are still inhabited. [4]. Their contemporary habitation and adaptation are evident in the establishment of their extensions, [5] With their traditional houses well documented, the Toba Batak houses provide us with good standing to trace the sustainability of their adaptations. A study of their extensions highlighted patterns of continuity, partial or complete, or disruption in their adaptation process.

A Toba Batak settlement in the form of a kampong, well known as *Hutas,* is a series of row houses facing each other with the main circulation route and public spaces in front of them, forming a linear configuration. Some traditional *huta* are still actively inhabited with transformational variations to the original houses. Our study will emphasize these variations, most in the form of additions to the originals. Previous studies documenting the additions introduced complementary findings that we may derive from direct observation.

Our study looks at these additions under computational analysis, filtering the objects under calculable parameters to give panoptic views beyond direct observations. Based on their occupancy and accessibility, we selected four villages from different locations in the Toba Batak region, two from the west and east side of Samosir Island: *Huta*raja, Lumbansuhi-suhi and *Huta* Siallagan, Ambarita, and two from the mainland Sumatera Island, each from north and south: *Huta* Ginjang, Sianjurmula-Mula and *Huta* Namora, Silaen respectively, to cover the variety of houses following dissemination of settlements based on prior historical studies [6] Discussions on this study will act as a second layer of observations to better understand the context of the original intentions of the house and its adaptations.

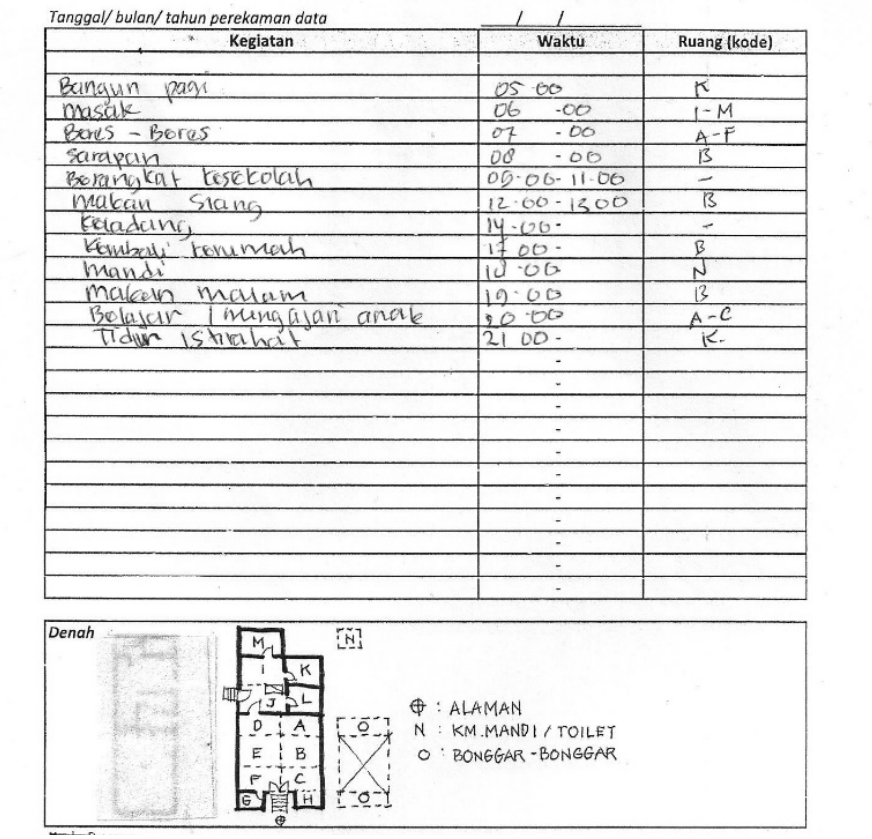
2. MULTIPLE METHODS FOR MEASUREMENT

Multiple computational analysis tools: Space syntax [7], shape grammar [8], building performance analysis, and general cost assessment, are employed to investigate the pattern of the houses' extensions. These will complement and be based on direct observations and archival studies. The evaluations of the extensions would be benchmarked in their contemporary context with traditional precedents in the background. We look for patterns of adaptations in each of the fields of investigations: social structure, cultural significance, building performances, and economic viability. Lastly, we seek also to understand the characteristics of continuity, deviation, or reformation of the present adaptations reflected in their extensions by looking at their connections.

3. FOUR AREAS FOR ASSESSMENTS

3.1. Social Structure Through Configurational Analysis

As means to represent and analyze the intangibility of activity and space-use, mathematical tools of graphs [9] and space syntax computational analyses [10] are used. Representation in the form of graphs and space syntax analysis will be the main arsenal of the study. The primary data for analysis are redrawn plans of the houses and occupants' daily routine, recorded in an "activity diary", an adopted approach in vernacular-inspired housing research [11] to get a more accurate recording of activities through the ease and freedom of making personal 'diaries'. (Fig.2)



Tanggal/ bulan/ tahun perekaman data / /

Kegiatan	Waktu	Ruang (kode)
Bangun pagi	05 00	K
Masak	06 -00	I - M
Beres - Beres	07 - 00	A - F
Sarapan	08 - 00	B
Berangkat kesekolah	09-00- 11-00	-
Makan siang	12-00 - 1300	B
Beladang	14-00-	-
Kembali kerumah	17 00 -	B
Mandi	18 -00	N
Makan malam	19-00	B
Belajar / mengajar anak	20 -00	A - C
Tidur istirahat	21 00 -	K

Denah

Fig. 2: Sample of activity diary, sketches of house plan and space coding.

Space syntax analysis provides a science-based and human-focused procedure to illustrate the characteristics of configurations [12]. By inquiring about relationships between spatial layout and social, economic, and environmental phenomena. Social interaction and movement in each dwelling with data sourced from the diaries and the relationship of the spaces are illustrated in the form of justified plan graphs. [13]. Using justified graphs, one investigates the permeability and connectivity of rooms associated with social structure or hierarchy.

We surveyed each house for its occupant's daily routine and use of space to understand the program of the house. House plans are then represented in Justified Plan Graphs to visualize the relationship between home zones and observe their patterns. In summarising Hillier, Dawes proposes three main stages of space syntax analysis [14]:

1. Abstraction into components, represented in maps or graphs (mathematically)
2. Mathematical measurement or calculation of topological properties (T.D., MD, C, R.A., I)
3. Interpretation of previous mathematical measurements to social and cognitive properties of plans.

In the first stage, we model the original houses' house plans in justified graphs. (Fig. 3) Based on our earlier archival studies, we interpolate their intended activities as previously documented [15] into the diagrams of plans. We used typical house plans from known house types: sitelumbeo, siamporik, the converted *sopo* and the later, more simplified version of *ruma*: the *angkola* type. Both data types, the plans and their activity are based on interviews with a tukang, a Toba Batak skills man and available documentation.

Plans of extensions are next to be modelled in graphs in two phases. The first phase of the second stage simulates additions as independent units combined with the original in the second. (Sibeth et al., 1991; Sitorus, 1961) (Fig. 4) In Rhino 3D modelling software ("Rhino 6 for Windows and Mac," n.d.), we utilize a space syntax analyses component, "Syntactic", developed by Pirouz Nourian (Pirouz Nourian (Nourian, 2017; Nourian et al., 2013; "pirouznourian - SYNTACTIC," n.d.). The resulting graphs from house plans provide base configuration modelling for the next phase of space syntax analysis in calculating the Depth of configuration, individual room's depth (L), total depths (T.D.), integration values, choice, and control values. (Table 1) Reading the abovementioned values, one may gain insight into the original houses' and extensions' configuration characteristics.

We identify their characteristics by looking at depth values and graph types. First independently between the traditional houses' graphs and their extensions, and second the combination of the two. We observe the Depth and configurational shapes. Later from the graphs, we kept branching vertexes and their number of edges, taking notes on (1) the number of branches and (2) room programming. Since information on how a person uses and name a room may differ from one dweller to another, we applied two stages coding procedure for consistent labelling of the room. We create categories of a room based on their activity types, not enforcing labels or conventions. For example, what may seem like a large living room in the house's main hall may be used as a sleeping area or guest space in their room label.

3.1.1. Depth Patterns in Graphs

With Depth in space syntax defined as the number of steps (or room) from the *alaman* as anchoring space, we observed in our graphs of the traditional houses an average Depth (L) of two (Table 2). Notable variations are in the number of vertexes in the graphs at Depth L=2, translated as rooms or functional spaces in a plan. In this level of Depth, the model shows a different number of *jabu* or living units and jambur or storage spaces. Their number varies from two to six. Traditionally, this is how the Toba Batak subdivide the main hall of a *ruma bona* into several inhabitants as family units. As a communal house, the number of *jabu* increases as the number of the family is added. A traditional Toba Batak house may have divisions of *jabu* of two, four, or six. Each room earned a unique name: *jabu bona*, *jabu tampar piring*, *jabu suhat*, *jabu soding*, *jabu tonga* ni *jabu bona*, *jabu tonga* ni *jabu suhat*. (Fig. 3)

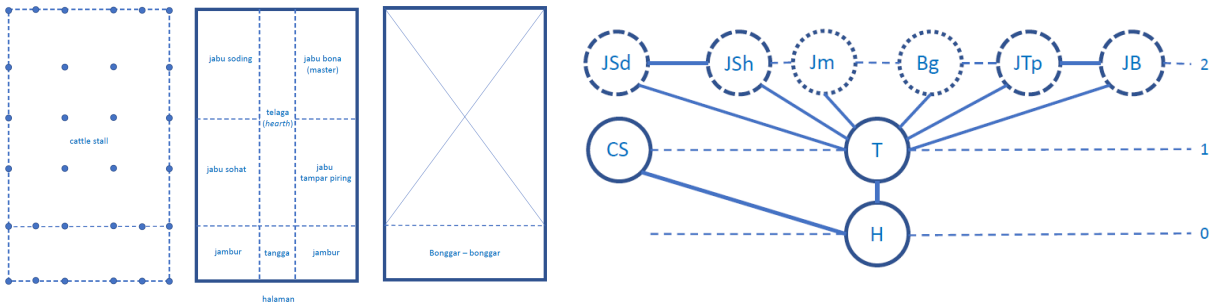


Fig. 3: Typical division of spaces and the naming of *jabu* inside a Toba Batak traditional house (left) and its representation in simplified graph. (right)

Unlike the *ruma bona*, a converted *sopo*, traditionally known as the male's house, separations are unknown. The primary platform serves as one living unit. In one of our sample houses, we found a practice of separating the platform's back and front areas to distinguish between the public and private zone.

The shape of the graphs is usually shallow and resembles bushes. (Fig. 3) The bush density varied according to the addition of the *jabu* and storage unit. From their consistency in depths, we acknowledge that the graph type is shallow and "bushy", and the density of the "bush" depends on the number of living units and storage spaces the house possesses. The house plans also communicates three levels of a Toba Batak house: the living spaces, including the hearth, or *tataring* and network of *jabu*s on the upper ground floor. Kandang, where villagers kept their livestock, are on the ground floor, and a mezzanine level called bonggar is used as storage space and a stage for musicians playing on occasion. In early travel notes and reports by Modigliani [16] and de Boer [17], a latrine-like hole can be found in front of *tataring*, rendering the kendang below as service spaces.

Configuration Analysis
Experimented Housetypes

K	*Number of nodes (functional space)*	
L	*Depth, distances from carrier (eksterior/* Alaman *(A))*	
TD	*Total Depth*	∑ (0 x nx) + (1 x *nx)* + … (*X* x *nx*)
MD	*Mean Depth*	*MD = TD/(K-1)*
RA	*Relative Asymmetry*	*RA = 2(MD-1)/K-2*
i	*Integration*	*1/RA*

	Analysis	Sitelumbeo (1)	Sitelumbeo (4)	Sitelumbeo (6)	Angkola (1)	Conv. Sopo (2)	Conv. Sopo (1)	Siamporik (2)	Siamporik (4)
K	*Number of nodes (functional space)*	*8*	*11*	*13*	*4*	*4*	*5*	*6*	*9*
L	*Depth, distances from carrier ("Alaman" (A))*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
D 0	*number of nodes in depth = 0*	1	1	1	1	1	1	1	1
D 1	*number of nodes in depth = 1*	2	2	2	2	2	2	2	2
D 2	*number of nodes in depth = 2*	5	8	10	1	1	2	3	6
D 3	*number of nodes in depth = 3*								
D 4	*number of nodes in depth = 4*								
D 5	*number of nodes in depth = 5*								
TD	*Total Depth*	12	18	22	4	4	6	8	14
MD	*Mean Depth*	*1.71*	*1.80*	*1.83*	*1.33*	*1.33*	*1.50*	*1.60*	*1.75*
RA	*Relative Asymmetry (of carrier)*	*0.24*	*0.18*	*0.15*	*0.33*	*0.33*	*0.33*	*0.30*	*0.21*
i	*Integration (of carrier)*	4.20	5.63	6.60	3.00	3.00	3.00	3.33	4.67

* Room with *L* higher than *MD* is less accessible

Sitelumbeo (x)	*Ruma Sitelumbeo type* with x number of *jabu*
Angkola (x)	*Ruma Angkola type* with x number of *jabu*
Conv. Sopo (x)	*Converted Sopo (granary)* with x number of *jabu*
Siamporik (x)	*Ruma Siamporik type* with x number of *jabu*

Table 1: Comparison of space syntax analysis between original (traditional) house types of the Toba Batak

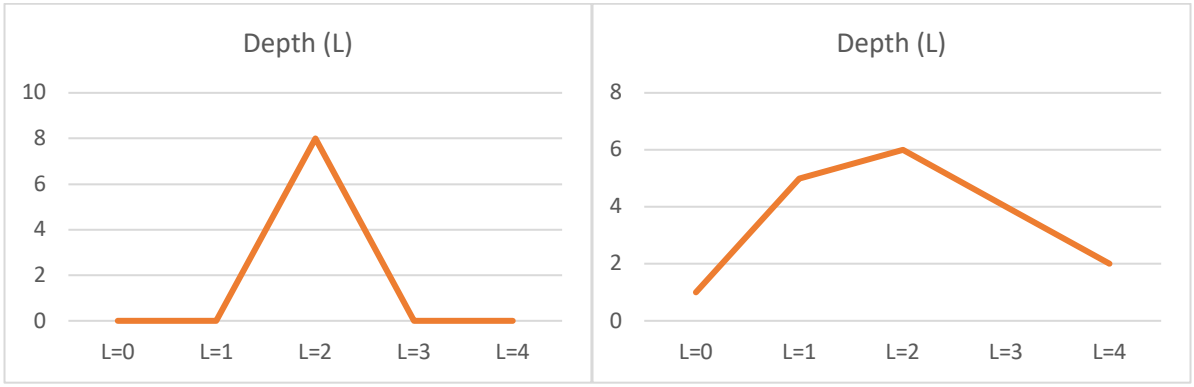


Table 2 Depth (L) comparison of original, traditional houses, a consistent level of depth value (L)=2 on the left and Depth (L) comparison chart of the extensions on the right.

3.1.2. Parallel Functional Spaces (Characteristic of Functional Spaces)

Most extensions include a kitchen, toilet, extra living room, dining room, or extra bedrooms. Some living functions may occupy the same space in an open plan configuration. For example, it is common for the kitchen to be a dining area or share the exact location of the living room. The communal character resembles the hearth (*tataring*, in Toba Batak) in the original house. This space is characteristic, as illustrated in broader examples by Waterson, of the southeast Asian dwellings [18]. The parallel suggests a continuation of a structure

in space occupation, revealing their social characteristics. The hearth, *tataring*, holds a central position in the house's configurations, as demonstrated by the high integrity (I) and choice (C) value (Tables 1 and 2).

Service spaces are separated in both the traditional houses and the extension. The previous performed the separations by placing them vertically on different levels while the latter in separated sheds or building attachments. The massing typology (Fig. 13) and the joinery provide visual clues of the separation. Even when they are visibly attached to or inside an extension building, most still have a separate entry, accessible from outside or *alaman*. In every *huta*, we encounter samples of bathrooms located at the back of the house. All of which with access to outside of the house.

Another parallel to their original houses, the configuration of extensions follows a similar pattern. The placement of bedrooms anchoring a central living space in the additions follows the *jabu* and *tataring* in the traditional house. (Fig. 4 and 8) Growth and extensions follow this structure, visible in the simplified graphs. Complexity in the original and the extensions result from adding more *jabu* or bedrooms. One may add another level of sophistication by adding another anchor, the living space and iteratively adding bedrooms attached to it.

3.2. Cultural Patterns

For the Toba Batak, their house is essential to their belief and the conduct of their traditional law or *adat*. [19] Construction of their homes, as is typical in Southeast Asia dwellings, is guided by their rule and is their representation of them. Domenig [20] presented an example of constructing *Sopo*'s timber posts. Its post configuration and sequence in its assembly reflect a given meaning and hierarchy. In our construction sequence diagram (Fig. 6), the Toba Batak is shown to have had several rituals essential to the whole process.

Development of a Toba Batak house and its preceding *huta* may take several cycles of harvesting, commonly every four to six months, to finish. Each is marked and coincides with rituals, marking the end and initiating the beginning of the construction process. Ritual markers also present an opportunity for recess to give time to resource the projects or if they would like to pause for another occasion. Take, for example, the process of woodworking and constructing the house's substructure. A sequence of timber cutting and making (*mangkeke hau*), making holes for mortise joints or "*manuhil*", and column–beam assembly or "*mangaransang*" ends with a ritual, also part of the construction stage of erecting the whole assembly of posts. A feast will mark the completion; should they choose to, they can have a break in the middle of the process. The extensions with living units, usually with masonry construction, do not submit to the process except in the beginning phase when house inhabitants apply for a permit from the village's chiefs.

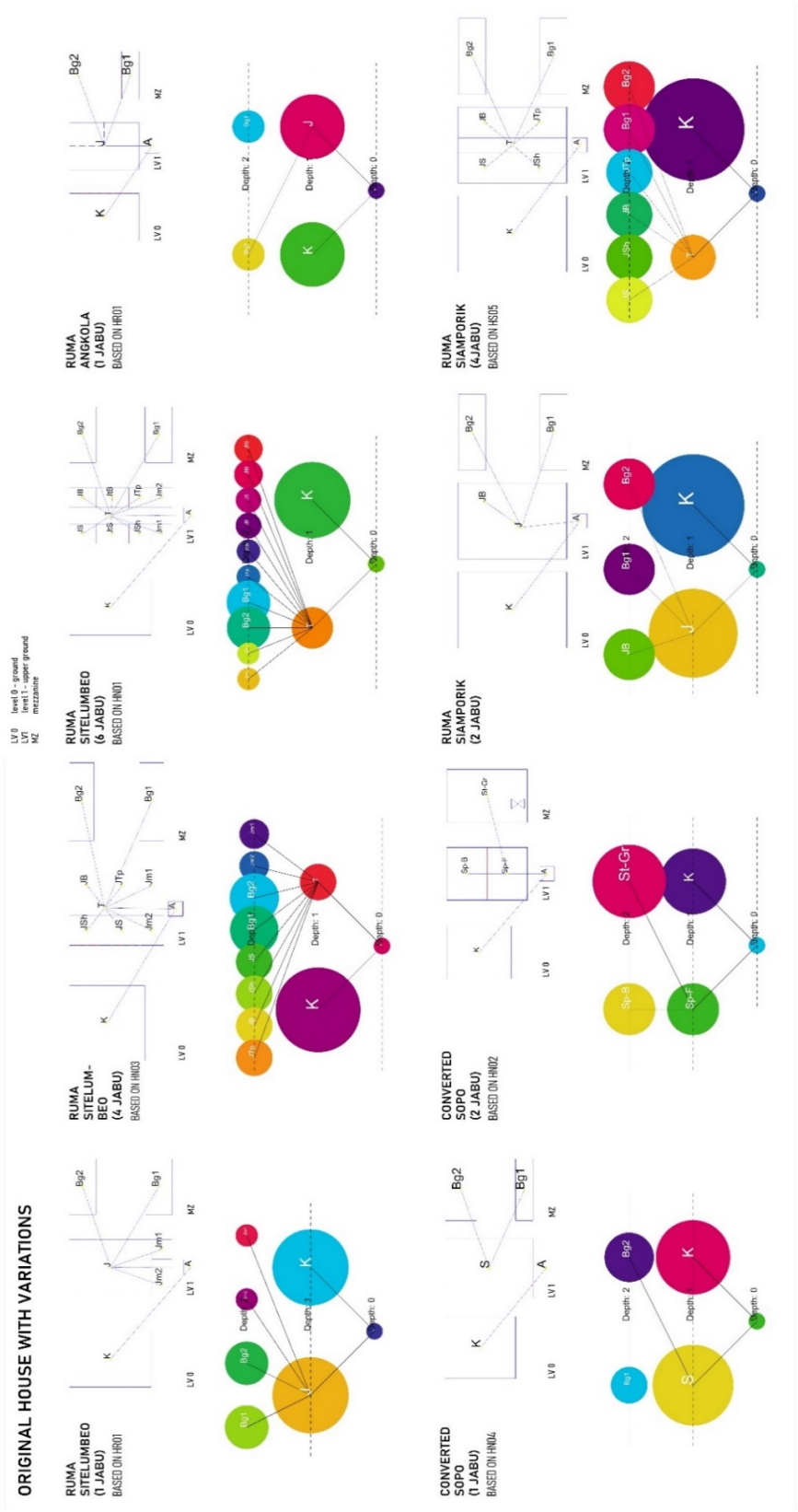


Fig. 4: Justified graph of simulated traditional house plans, generated using "Syntactic" plugin in Rhino3D.

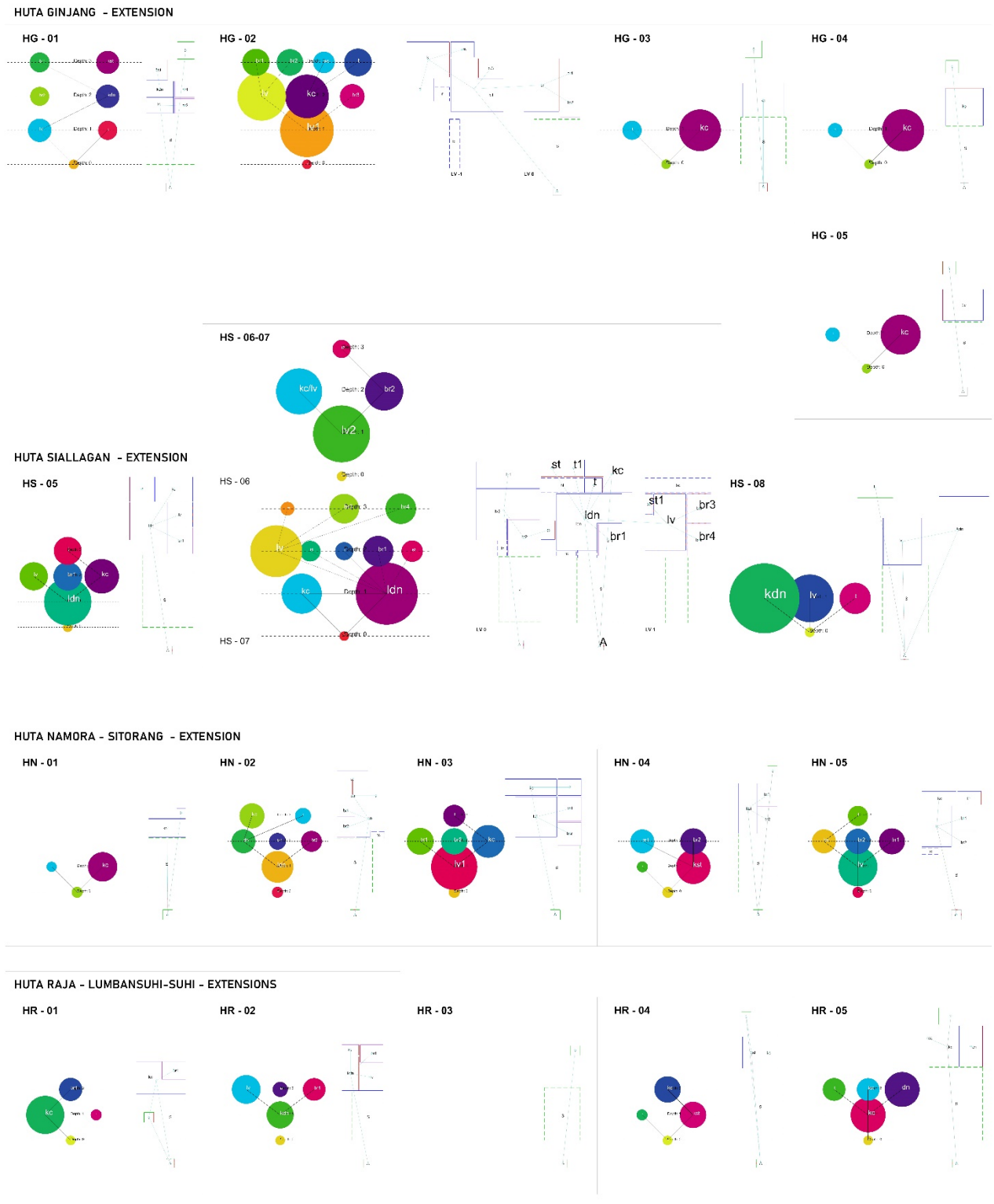


Fig. 5: Justified graph of extensions' plans, generated using "Syntactic" plugin in Rhino3D.

In their daily use, the thing of rituals and *adat* belongs to the original house. From interviews, they highlight the use and need for their traditional home to cater to their *adat* needs. While their separation is not assertive, It is clear that tradition-related activities are primarily held on the originals. Gathering concerning community issues in any number, large or small, is usually held in the original house. In large gatherings, the functional superiority of the traditional cater is evident. The main hall can accommodate crowds of at least 40 people inside. The outside yard, *Alaman*, can hold even more significant events such as funerals and wedding ceremonies. One of the house's main features, the bongar-bonggar, the front part of the attic facing outside, is proudly known by the villagers as a stage for musicians on festivals. (Fig. 7) This tradition is perhaps mirrored in the current practice of having ceremonies in the front yard of the more modern version, non-traditional houses. These houses usually do not reside inside a traditional *huta*. When spaces are limited, using part of the public road is common. Daily, some Toba Batak still put a plate and food in a wooden plank tying the top part of posts, symbolling their ancestral respects. These practices are not apparent in their extensions.

Traces of the traditions or rituals are scarce in their extensions. Most of the additions serve practical space necessities and services: kitchens, sometimes doubled as a dining room, and toilets; they rarely accommodate cultural purposes. On extensions with living spaces: bedrooms, and living rooms, they rarely host cultural events or even social events in large numbers aside from the everyday chatting and neighbourhood visits. In dwellers' comments, their original houses are set aside for more formal occasions. It is especially true for those with extensions with living spaces to cater to their daily activities. For example, the attachments at *Huta* Siallagan resemble another independent living unit where all their daily space is accommodated. Therefore, their traditional houses are usually utilized as living and guest rooms where they host guests with *adat* intentions or not.

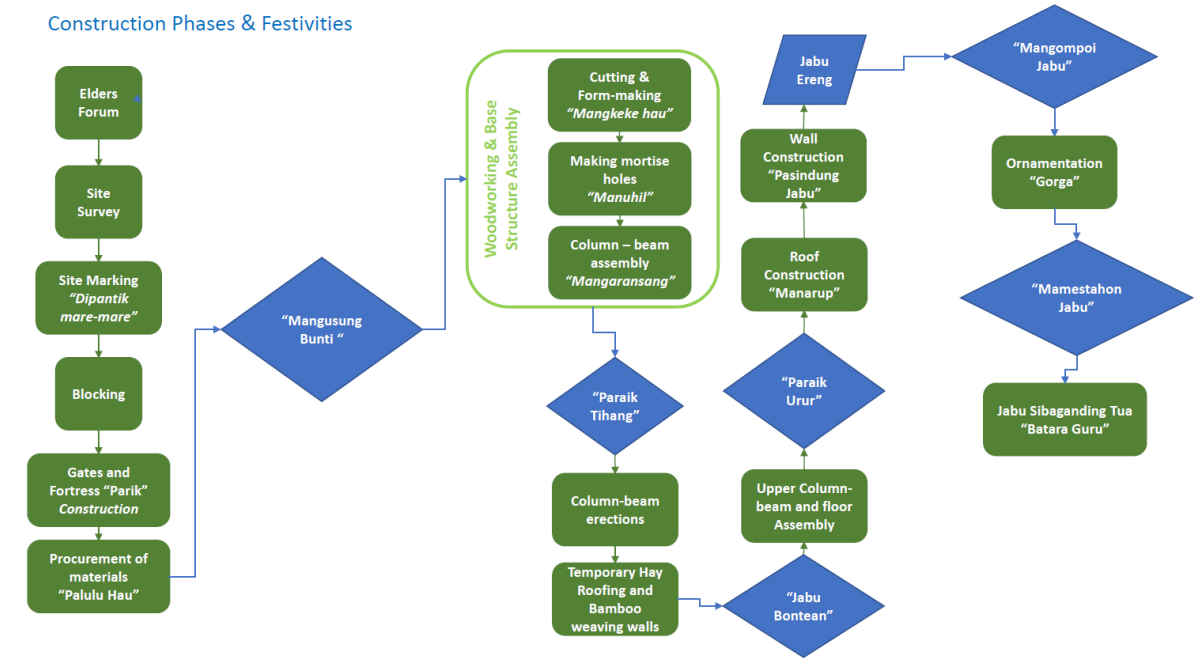


Fig. 6: A Diagram showing construction phases and the accompanying rituals or festivities.

Fig. 7: A burial ceremony at Harianboho, 2002. Guests gather at *alaman*, and musicians take place at *bonggar-bonggar*, the house front attic, to perform the musical rite. (left) A more common, current-day practice.(right)

3.3 Building Performance Assessments

3.3.1 The Basis for Performance Assessments

To determine the building performance aspects, we interviewed the inhabitants of the surveyed houses. From their responses, we acquired a categorical perception hierarchy of building performances, which matters most, and which are less. Above 80% of the inhabitants expressed their satisfaction with the house's climatic adaptation responses. They rated "good" or "very good" when questioned about their houses' climatic adaptations concerning rain (89%), humidity (94%), heat (96%), and resistance to earthquake forces (83%). Inhabitants' perceptions of the house's adaptation to cold weather and resistance towards lateral forces from

winds are slightly lower at 78% and 61%. Based on the interviews, we investigated the houses' adaptational performances based on comfort, daylighting, shading, ventilation and wind forces analysis.

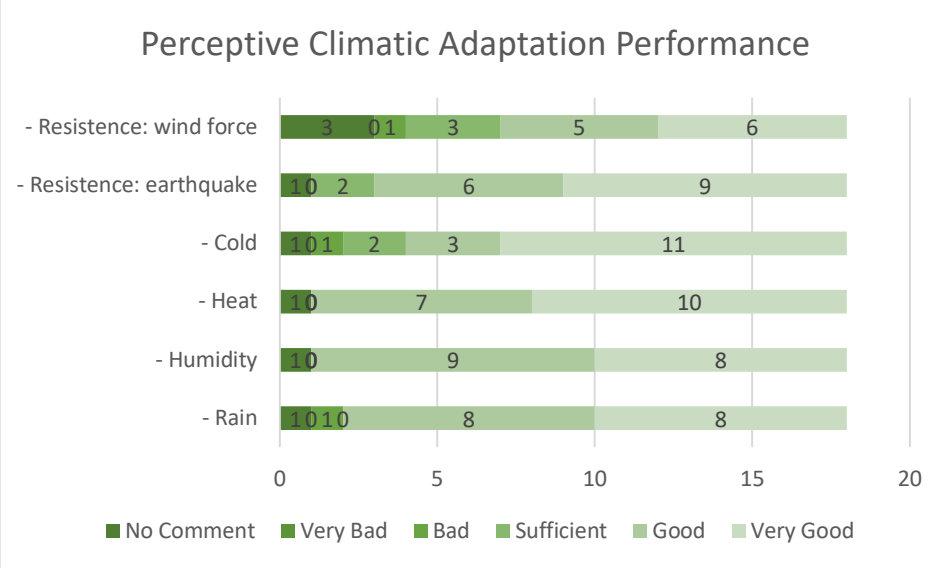


Table 3: Perceptive Climatic Adaptation Performance Chart

Measured parameters to assess environmental adaptations of the houses looked into principles of passive cooling and heating, energy simulations, shading studies, and daylighting studies. We did not look at aspects of structural integrity concerning its resistance to earthquake forces. We refer to other studies on Toba Batak houses to reflect on their adaptational capabilities in resisting earthquake forces compared to their extensions[21].

Building comfort in this study is perceived as thermal comfort, defined as the occupant's sense of satisfaction with the thermal condition of a building [22]. We assessed building performance through simulations of 3D models in Rhino 3D modelling software. Using Ladybug, a parametric environmental simulation plugin for Grasshopper [23]. Grasshopper is algorithmic visual programming within Rhino. The simulation focused on passive design features of the extensions using the plugin [24]. We observed minimal mechanical intervention in the houses to achieve or alter interior thermal comfort. With this approach, our focus will be on the house itself and its integral elements and not on the active conditioning of the house.

In the simulation, we assess how the houses fare with existing thermal conditions using yearly climate data for simulations in .epw format from one building (https://climate.onebuilding.org/). One should note that weather data is taken from a nearby station in the city of Medan. However, with slightly different average temperatures and wind, it still represented the macro climate conditions of the *huta*.

3.3.2. Shading

The first findings are from sun studies illustrating the shading conditions of the houses. The original traditional houses with protruding saddle roofs provide shading for the entire front and back end. The average roof protrusion reaches almost 0.47 of the length of the house's walls. Using that proportional rule, an average 7-meter-long traditional house, measured without a roof, will have a roof protrusion of 3.29 meters. From our simulation using the yearly sun path, the front and back end of the house is shaded all year. The same cannot be said about extensions with short protrusions as under the eaves of a home, some with a length of only 50 cm short.

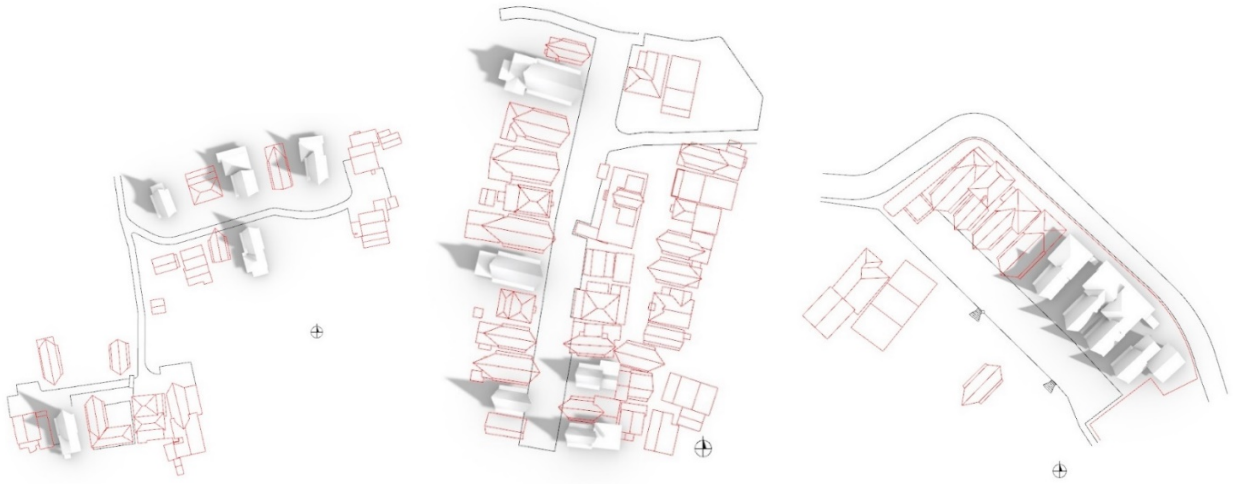


Fig. 8: Sunstudy, showing the longest shadow appeared (in July). From left to right: *Huta* Namora Sitorang, *Huta* Raja Lumbansuhi-suhi, and *Huta* Siallagan, Ambarita.

3.3.3. Daylighting

In daylighting simulations, the house's dark interior contrasts with the typical extension performance. Exceptions are in additions to solely service functions like bathrooms and the practical, "dirty" kitchens. As seen in Figure 15, sun highlighted areas are only those close to the small windows of the house measured around forty by forty centimetres. The rest of the house is dimly lit, creating dark interior images. Aside from windows, lights may also penetrate gaps between wood planks in walls or gables. However, extensions with additional living areas (Fig.16) are significantly lit.

The dark interior of the original with less energy absorption, with the lower value shown in blue hues, provides a perceptively cooler interior in hot and humid tropical climates. With the house being on stilts, the climatic adaptation performance only gets enhanced by allowing the breeze to pass through gaps from the floor and walls. Living areas and even some of the bedrooms in the additional building have significantly

higher energy or heat from the light. It is a consensus, as we gathered from our respondents, that their original houses are more comfortable to live in.

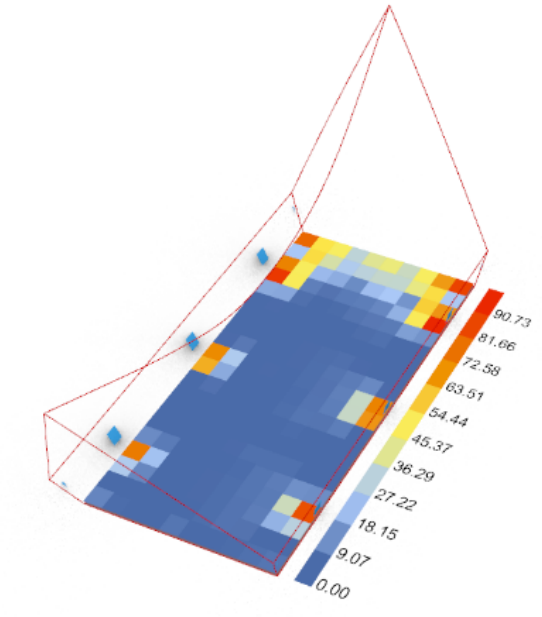


Fig. 9: Typical Daylighting analysis of the traditional Toba Batak house.

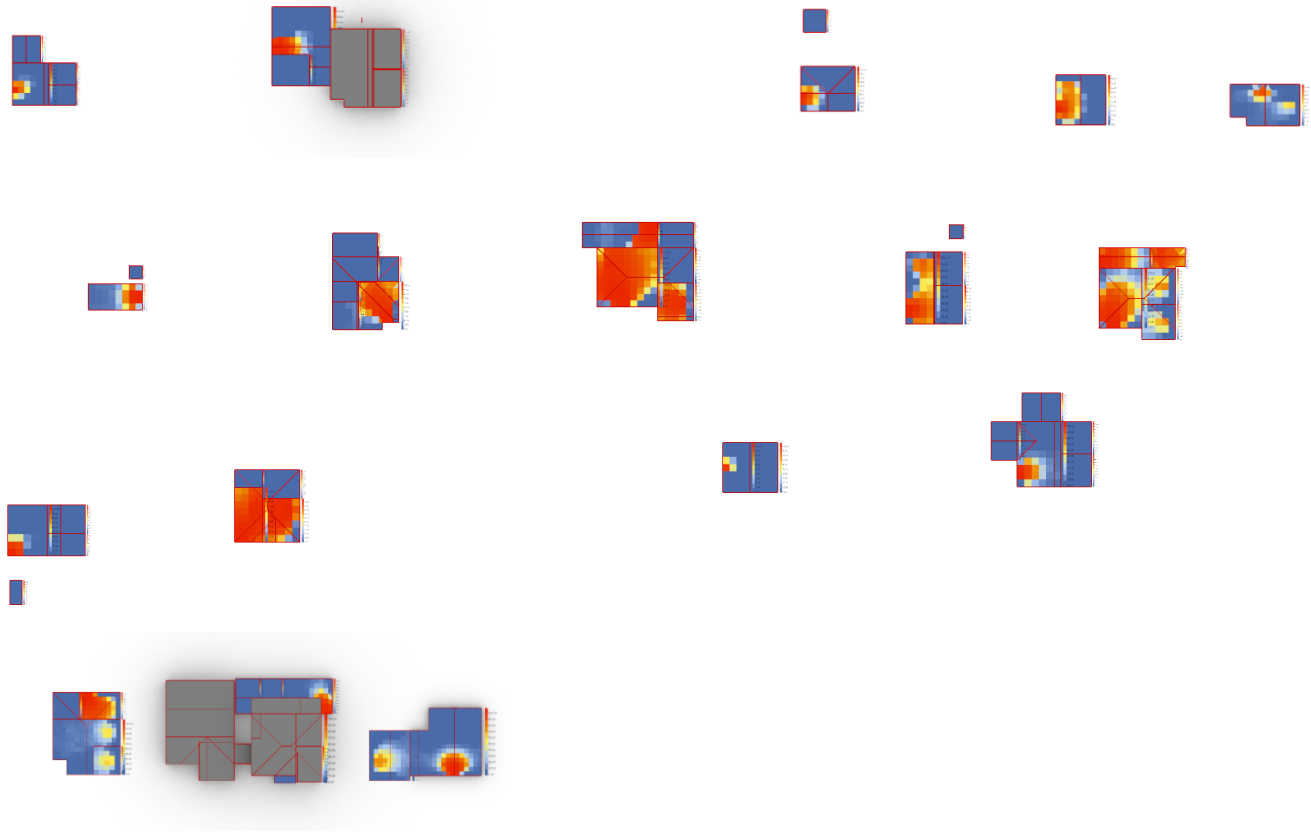


Fig. 10: Daylighting Simulation of Extensions. From the top row: *Huta*ginjang, *Huta* Namora, *Huta* Raja Lumbansuhi-suhi, *Huta* Siallagan.

3.3.4. Wind Tunnel Simulation

Wind velocity, especially in the coastal area of lake Toba, may reach up to 20-24 m/sec on a more consistent base. From February to April and again from July to September the occurrence of wind with such velocity are typical. The region also has a higher average than other parts of north Sumatra province. [25]. Our respondents have typically voiced their experience with such winds, which may create noises from moving house parts. The traditional house design has adapted to wind conditions well, with no reported damage to the house.

From our graph simulations of the house's original extensions (Fig. 11 and 18), we may see that wind speeds are relatively similar from their approach to after they pass through. The colour indicator shows the same wind pressure before and after passing the house. In extensions with the same scenario for the testing, different results are shown from the change of colour indicating wind velocity. The speed is reduced after passing through the house's mass. Apparaent difference from the two scenario are in the shape of the house, or particularly the shape of the roof. With less perpendicular angle towards wind direction, the traditional house gives less resistance and consequently less drag, allowing wind to pass through without lasting effect on the house. The more bulky extensions with gable or hip roofs presented more wind resistance. Highlights of the drag can be observed in the corners of the house. While the new extensions work by withstanding the force, the old traditional house works by accommodating or channelling the wind force. Hence, they do not present hazards.

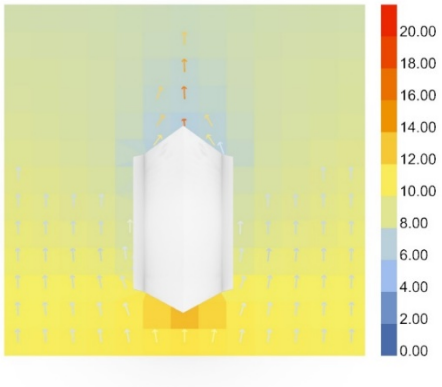


Fig. 11: Wind tunnel simulation of typical traditional Toba Batak house.

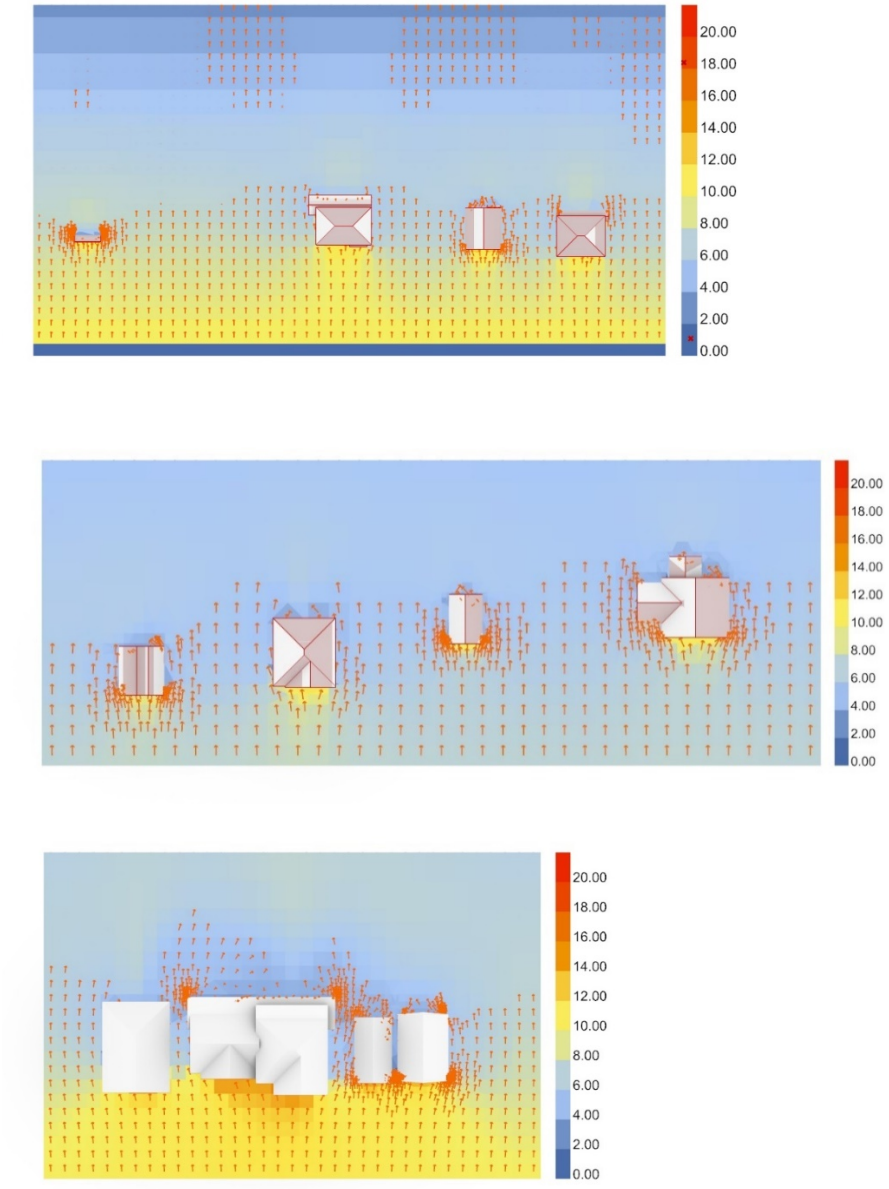


Fig. 12: Wind tunnel simulation of the extensions. From the top row: *Huta* Namora, *Huta* Raja, *Huta* Siallagan.

3.4 Economic Viability

Among previously noted major disruptions to traditions is its economic affordability [26]. Extensions to the *Ruma* bolon use different materials and construction methods than the original. Added programs ranged from a kitchen, additional bedrooms, and a toilet (usually in a separate building) to extra living spaces with various uses; some featured as multifunctional spaces. (Fig. 4). Constructions vary but can be grouped into three main methods: simple timber frame construction, masonry constructions, and combinations. Timber and masonry as primary materials are chosen for their availability in the present-day Indonesian construction market.

Material availability dictates pragmatism to the extensions as they add a practical program to the originals. Their constructions usually are true to their purpose and unrefined in comparison. The size and quality of the beams (sumbaho) and posts are in stark contrast to the ones used for extensions. Timber columns in extensions use four by four centimetres up to 10 by 10 centimetres in rectangular sections; about half of the originals of round timber logs (hardwood) of 10 to 30 centimetres in diameter. The cost for timber construction of similar sized and characteristics is simply unaffordable and unavailable in the Indonesian common market due to the limited supply of legal timbers appropriated by Indonesian timber regulations and its Timber Legality Verification System (*Sistem Verifikasi Legalitas Kayu* - SVLK). The use of masonry construction follows similar logic of availability, thus affordability.

A survey on popular construction sites and the Indonesian government's standards from the National Standardization Agency of Indonesia for constructions shows a significant difference of 5: 1 between traditional and typical masonry constructions according to the national standards. Simple frame timber construction and mixed methods reveal a starker comparison of 11.7 : 1 and 16.8: 1 (Table 3). The comparison is by comparing standards and best-known practices. The recent development of Traditional Batak Houses at *Huta* Siallagan from December 2020-June 2021, built in current market value and funded by the Indonesian government as part of the "5 Super Priority Regions of KSPN" initiatives, provides us with a benchmark. One traditional *Rumah* Bolon, roughly 5 meters in width and 7 meters in length, has a project value of Rp.500.000.000,- -Rp.600.000.000,- (based on an interview with local villagers also appointed as village coordinator of the project.)

Average Construction Cost (per sqm) in Indonesian present economy (2020)				%	
Construction Type	***Median in IDR***	***in AUD***	***Ratio***	***labour***	***material***
traditional	Rp 14,285,714.29	$ 1,386.96	BM*	60%	40%
masonry	Rp 3,065,244.74	$ 297.60	4.7	30%	70%
mixed	Rp 848,738.88	$ 82.40	16.8	25%	75%
timber	Rp 1,216,318.48	$ 118.09	11.7	18%	82%

Table 4: Construction Cost Comparison.

4. RELATIONSHIP WITH THE ORIGINAL

Relational development of the house is generated by modelling shape transformation of spatial generation of the house extensions and comparing them to the original traditional homes. The extensions' plans are compared with the original and their construction type, elevational shape, and materials. Mass development follows the rule of addition to the back for the first mass added. The second mass addition was placed on the sides of the first (Fig. 13). Their development pattern is consistent and in keeping with the decorum of the village and a gesture to respect the original house.

We also look at their connection point, how the extensions meet the original and what kind of transformational adaptation they take. Visual representations in photographs and three-dimensional modelling collections present the inhabitant's efforts for connection. Most of the connections from our observations display minimum intervention to connect to the traditional, especially apparent from extensions constructed with different materials and building techniques. Differences in height are solved mainly by introducing stairs to accommodate typically adopted masonry houses that touch the ground below and not on stilts like traditional houses. (Fig. 14)

Various construction types employed in extensions contrast with the original's homogenous timber construction, categorized into three: masonry, timber, or a mix between the previous two. A mixed structure is usually a masonry substructure and wall with waterproofing up to one-meter height and wooden planks with timber roof construction. The combination provides better resistance to the humid tropical ground where concrete and masonry are touched. Their ancestor mitigated the problems by employing stilt structure on their otherwise susceptible timber structure.

A shift from the intricate, no nail required, timber construction as it stands is a sensible economic decision. With timber material in required size and volume becoming scarce and expensive, readily available masonry with cement plasters is the option. Timber harvesting is regulated, and the community depends on logistics from local material suppliers, or "panglong", as they called it. However, the somewhat uncoordinated connection between old and new materials suggests disruptions in their adaptations. Images of exterior and interior areas reveal gaps, abruptly trimmed roofs, wall parts, timber posts or steep stairs. (Fig. 14) These are pragmatic approaches compared to the original house's more "finish" product.

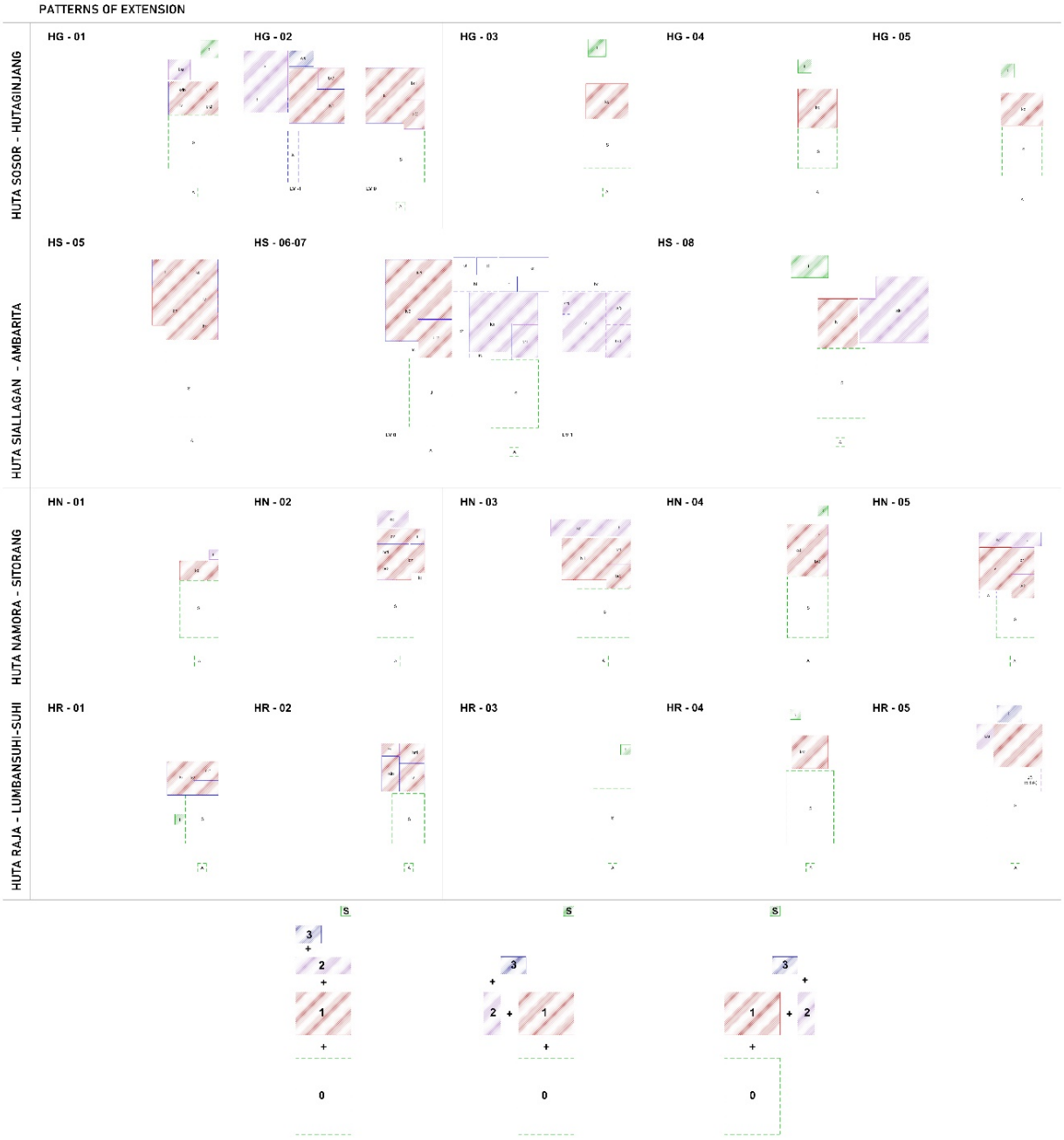


Fig. 13: Mass Extension Patterns.

Fig. 14: Connections at *Huta*ginjang, Sianjurmula-mula, Samosir Regency.

5. CONCLUSIONS AND DISCUSSIONS

From our fieldwork houses, their form of current modifications practised multiple attitudes for adapting. By connecting the findings of each assessment, we may conjuncture a narrative for their contemporary adaptation. (Table 5). The Toba Batak preserves their cultural structure with a traditional house as the physical representation of their *adat*. In compensation for Toba Batak's evolving space requirement and inherent social changes: the need for privacy, increasing inhabitants limited by the change of character from a communal house into a single-family home, they opt for masonry construction more fitting to their financial capacity. In doing so, they may compromise their house's climatic adaptation performance.

Their decision to preserve their social structure is apparent in their pattern of configurations. Disruptions affecting their social system, the issue of privacy and gender are now dealt with swiftly with direct separation in walled rooms. *Ruma* Bolon's open plan house was appropriated by separating gender into two completely different places when they reach adolescence. This practice invoked nicknames their '*Sopo*' or granary as the male's house and *ruma* or *jabu* as the female's house. [27]. The present state of *sopo* can not cater to such needs, as they, too, convert into a single-family home with internal separation inside the original or extensions of the house.

	Parameters	Representation	Extensions performance
Economy	Material cost Labour cost	Colour coding spreadsheet	the original is more expensive for current conditions and is not always available.
Social	Space program Flow of activities User interactions	Justified graph	An open plan encourages more connections but with a social rule to be implemented for it to work. Extensions provide better privacy and services.
Cultural	Construction process Rituals/hierarchy	Directed network graph	the original sustained cultural customs, mainly catering for ceremonies and large gatherings of people.
Environment/ Building performance	Materials source Microclimate quality (Cooling,daylighting, shading)	Ladybug simulation	the original performs better in terms of thermal comfort and provide shading all year round for interior and exterior (terraces).
Relationship to the original	Form factor Modes of Expansion (Copy/attached/detached/addition)	Shape development patterns visual observations	Extensions are usually attached to the original with minimal effort to harmony. Differences in material and construction methods provide starker contrast.

Table 5: Multiple Parameter Adaptation Patterns of Extensions.

A study of the house's additions incites clues to the next iteration of traditions, their trajectory, and how one may anticipate future adaptation. By comparing and modeling the extensions into charts, followed by building performance analysis, one is presented with alternative models to highlight continuity, partial adaptation, or abandonment of their traditions.

This study's work and analysis highlight the complexity of overlapping patterns of the vernacular. As mundane as it may seem, a house is a concentrated layer of adaptations, preserving an intrinsic structure. Although perhaps superficial, one may observe economic, social, cultural, and environmental transformations from graphs representing traditional houses and their extensions to quickly observe the trajectory. Future

studies may use this data-based computational approach to look into patterns and their apparent or fading changes. Multiple data collection for numerous analyses is required to utilize computational inquiries properly. In the process, those data interact and give feedback to the subsequent iterations until a pattern emerges.

What we presented here suggests an inkling of the role of architects, designers and planners in a traditional community. The challenges of the Toba Batak may benefit from skillful directions from the well-informed. A remedy to their adaptational challenges is guidance to navigate the process by presenting an alternative to construction without reinforcing ideas or structure. Partial adaptation and compromises to the Toba Batak solution to their shifting social system would benefit from options in dealing with the building performance once superior. It is the helping hand required to get them through their adaptational process without enforcing ideas or structure to what is established. Or in other words, instilling stability in the change and adaptation process.

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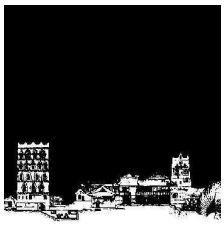

TRADITIONAL DWELLINGS AND SETTLEMENTS WORKING PAPER SERIES

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