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DECODING SPATIAL PATTERNS IN LOW INCOME URBAN HOUSING THROUGH VERNACULAR REFERENCES

**Ahmad Shuib Yahya¹, Nurul Syala Abdul Latip², Nasrudin Sharkawi³,
Ahmadsyafii'ei Abdul Kudos⁴ & Azrul Izwan Ismail⁵**

*^{1,2,3,4,5}Department of Architecture,
Faculty of Engineering & Built Environment,
UNIVERSITI SAINS ISLAM MALAYSIA*

Abstract

Rapid urbanization has increased the challenges of providing adequate housing for low-income communities, particularly in Malaysia, where 85% of the population is expected to live in urban areas by 2040. Modern housing development often prioritizes on efficiency and cost, overlooking the cultural and social dimensions embedded in vernacular practices. This study aims to examine whether the spatial patterns in low-income urban housing in the Klang Valley demonstrate any interaction with vernacular knowledge, or whether they have been entirely shaped by modern ideas. Using diagrammatic analysis through the space syntax method, the study compares the floor plans of low-income urban housing and traditional vernacular houses in remote areas of Peninsular Malaysia. Justified Permeability Graph are used to identify patterns of integration and segregation concerning access, movement, and spatial hierarchy. The findings reveal that although modern housing responds to urban living needs, elements of vernacular spatial logic do remain. However, there are significant differences, particularly in the relationship between domestic spaces and external areas. Urban housing tends to exhibit a more individualistic character, as regulated by government policies. Conversely, vernacular houses show a stronger integration between interior and exterior spaces to foster closer community ties. This study highlights the importance of integrating local cultural values into urban housing design in order to create more inclusive, meaningful, and socially connected living environments.

Keywords: Low-income group, Urban housing, Space syntax, Vernacular architecture, Justified permeability graph.

* Corresponding author. Email:

INTRODUCTION

Housing low-income groups in developing countries has been a major challenge faced by designers worldwide (Park, 2017; Trigueiro, 2015), especially since the end of World War II (Susanto, 2020; Grozdanović, 2017; Tosics, 1998). The rapid growth of urban populations; from one billion in 1950 to nearly five billion by 2030 (United Nations, 2019). This has placed enormous pressure on global housing needs. UN-Habitat (2016) predicts that around 40% of the world's population will require housing by 2030. Within the framework of the Sustainable Development Goals (SDGs), housing has become a core component in achieving universal well-being (Yahaya et al., 2017), supporting all the goals that encompass health, equality, economics, education, and environmental sustainability (UN, 2021).

The general view in urban planning suggests that housing provision should be driven by efficiency, density, and low cost. However, this approach often overlooks the social and cultural dimensions embedded in the spatial arrangements, especially within local communities. This raises critical questions. What social and cultural meanings are embedded in the spatial patterns of modern housing, particularly for low-income groups? Do such designs still relate to traditional spatial principles, or have they become entirely disconnected? In developing countries, nearly 40% of urban households consist of low-income communities dependent on government assistance (Zainal et al., 2012; World Bank, 2018; Hassan, 2022). In Malaysia, the Third National Physical Plan projects that 85% of the population will live in urban areas by 2040 (Rahman & Manaf, 2020). Therefore, the issue of housing cannot only be viewed from the perspective of compliance with international development goals, but must also be examined from the aspects of community formation and spatial culture (Yahya, 2023). The history of housing in Malaysia shows that policies such as the First Malaysia Plan and the New Economic Policy paved the way for the construction of modern housing like the Pekeliling Flats and Rifle Range Flats, inspired by European models (Yahya et al., 2021; Kamarul, 2009). These housing types have gradually replaced the vernacular houses that once served as the living spaces for communities in the Klang Valley (DRN, 2018).

Thus, this study seeks to explore the meanings hidden in the spatial patterns of modern urban housing in the Klang Valley, using vernacular housing as a cultural and social reference framework. Through a Space Syntax approach, this study will analyze how urban housing spaces are organized and function, and to what extent they still support traditional social logic or have been modified to meet the demands of modern development. This understanding will contribute to more meaningful, culturally rooted, and inclusive housing planning which values local community norms.

LITERATURE REVIEW

The Concept of Society and Spatial Logic

Understanding spatial configuration requires an understanding of the social logic that produces it. As argued in socio-spatial theory, space is not merely a physical container, but a structured manifestation of social relationships (Hillier & Hanson, 1984). In this context, Ibn Khaldun's theory of society provides a critical foundation for interpreting spatial organization.

Ibn Khaldun distinguishes between rural and urban societies based on the strength of social cohesion (Saleh 2008). Rural communities are characterized by strong collective bonds, where social relationships are embedded in everyday life. In contrast, urban societies tend to exhibit weaker social cohesion, as lifestyles become increasingly individualized and dependent on external institutions. This transition reflects not only a social transformation, but also a reconfiguration of how space is organized and experienced (Yahya 2023).

A similar distinction is observed in Durkheim's concept of mechanical and organic solidarity, where traditional societies are structured through shared norms and collective identity, while modern societies are organized through specialization and functional differentiation. Both perspectives suggest that changes in social structure are inherently linked to changes in spatial organization (Saleh, 2008).

This study interprets these sociological concepts through spatial configuration. In this framework, higher spatial integration and permeability are understood as indicators of stronger social cohesion, while deeper and more segregated spatial structures reflect increasing individualism (Hillier & Hanson, 1984; Yahya et al 2023). Thus, space syntax is employed as an analytical bridge to translate abstract social theory into measurable spatial relationships.

Ibn Khaldun's Views on the Societies

Ibn Khaldun emphasized that society is the foundation driving the formation of cities (Yahya, 2023). This process occurs when rural communities migrate to urban areas in search of specialized livelihood needs such as skills, craftsmanship, customs, and knowledge (Saleh, 2004). Cities thus emerge as open spaces accommodating various social backgrounds, without the clan-based ties common in rural areas. They are inhabited by individuals who no longer hold a secured position within their original society. Consequently, cities are designed by the state to ensure the safety and economic stability of their residents.

Various social amenities may be provided to support the relationship between the working community and national institutions (Masturi, 2001). However, the wealth created for the welfare of the people can eventually become a burden to urban society (Muah, 2020). It gives rise to a luxurious lifestyle,

dependency on systems, and economic fractures. In contrast to rural areas, which emphasize collective values, urban communities are more individualistic and often lack mutual recognition. They rely on enforcement and external agencies to navigate their daily lives (Saleh, 2004). This shift not only alters the structure of society, but reorganizes how space is arranged and utilized.

Contemporary Low-Income Group Communities

In contemporary society, income-based classification has increasingly revealed stark social and economic disparities. The low-income group, representing the bottom 40% of household income, often remains trapped in poverty, struggling to meet only the most basic needs such as food, clothing, and shelter (Ismail, 2019). Despite various forms of government assistance, the high cost of housing continues to burden this group, limiting their capacity to improve their standard of living (Yahya 2023).

Growing dependence on external systems in urban areas has eroded collective rural values, replacing them with a more individualistic lifestyle (Yahya et al, 2023). While cities promise economic opportunity, low-income communities suffer from ongoing financial instability, reliance on external aid, and limited access to upward mobility. In regions such as Kuala Lumpur and Selangor, the high cost of housing further widens the gap between high- and low-income groups (Ismail, 2019). This imbalance reflects a broader paradox, as urban environments, often viewed as symbols of prosperity, also generate complex social and economic challenges which have reshaped the structure of modern society.

Low-Income Groups and Urban Housing

The built environment is a crucial element to achieving a good quality of life (Sani et al., 2021). Although housing for low-income groups is often associated with affordability, they equally deserve access to quality living spaces that support residents' well-being (Yusuf, 2012; Junaidi et al., 2018). Housing design plays a significant role in shaping the social environment and contributes meaningfully to everyday life satisfaction (Sukimin, 2008).

A home is not merely a shelter, but a space that organizes economic and social activities (Fatimah, 2009). Changes in spatial configurations often reflect family dynamics, as dwellings evolve from simple, single-room units to more complex arrangements in response to growing household needs (Carsten & Hugh-Jones, 1995; Kuchiba et al., 1979; Idrus, 1996). Despite numerous references to quality housing for the low-income population, there remains no universally accepted standard for housing. This gap highlights the need for more structured and context-sensitive approaches to ensure housing quality for this

demographic (Ismail, 2019; Yahya et al., 2021). Even with limited financial resources, low-income households have the right to live in well-designed and dignified environments (DRN, 2018).

The Change in Housing Development in Malaysia

The history of housing for the low-income group in Malaysia is closely linked to rural-to-urban migration in search of better job opportunities and income (Ishak & Hassan, 1997). They were relocated to land near cities to meet the labor force demand and were provided with basic amenities such as electricity and water. New villages in urban areas emerged as informal settlements, with 23,970 such households recorded in 1999 (Juliana et al., 2014).

The Integrated Housing Program was strengthened under the 7th Malaysia Plan to relocate squatters into urban housing. The first phase of housing development began post-independence, with 143,461 housing units provided between 1957 and 1985, despite financial constraints and labor shortages (DRN, 2018-2025). From 1981, the government mandated that the private sector provide 30% of low-cost housing in every development project (DRN, 2018-2025). This had a positive impact, adding 121,855 low-income group housing units. In the 1970s, over 65,000 housing units were built in Kuala Lumpur for the low-income group, including low-cost flats with basic amenities, although design issues and population density affected comfort (Husna & Nurizan, 1987).

From 1970 to 2011, the construction of apartment buildings became a preferred solution to meet housing demand, with the objective of eradicating poverty and improving employment opportunities (Norsazalina, 2001). Private developers played a key role in these developments, and the design of low-income group housing emphasized a balance between social and economic needs (Idrus, 2003).

Social Standards and Urban Housing

In the context of urban housing design, the concept of standardization often emerges as a key issue. Standardization refers to an approach that prioritizes a uniform size or design without considering the individual needs and lifestyles of the residents. While it aims to meet the high demand for housing, this approach often overlooks the social and cultural diversity within urban communities. As a result, the spaces created in urban housing may fail to provide comfort and freedom for residents in their daily lives (Haniza et al., 2016).

One of the best options to gain insight for better design ideas is to explore vernacular housing, which is built based on the natural environment and local culture. Vernacular houses not only provide physical shelter but also reflect

the social patterns and diverse ways of life of their inhabitants. By studying the design elements of vernacular houses, we can introduce flexibility into urban housing design, making it more responsive to social needs, personal space, and the relationships between family members (Tagle, 2016). This approach not only seeks a balance between quantity and quality, but also values the diversity found in increasingly-complex urban life.

Revisiting Vernacular Knowledge in Architecture

The vernacular environment, as shaped by the community, serves as a rich laboratory of architectural learning resources (Rapoport, 1999). This environment not only reflects the relationship between humans, space, and form, but also encompasses knowledge of climate response, spatial organization, energy use, and environmental quality (Rapoport, 1999; Hanson, 1998). In this context, vernacular architecture has been recognized as a primary reference material because it manifests human social and cultural relationships in physical forms that are both practical and meaningful (Sadanand et al., 2021). Understanding these manifestations is especially valuable when seeking insights for application in modern architectural ideas. By studying vernacular architecture, we are not merely documenting traditional practices, but identifying enduring spatial principles that can inform contemporary housing design (Rapoport 1969).

A key dimension of this manifestation lies in how space is organized (Yahya, 2023). Rather than focusing solely on physical size or the number of rooms, what matters is the logic and structure of spatial relationships (Hanson 1998). It emphasizes that the significance of a home is not determined by its scale, but by how spaces are arranged and interconnected to support social interaction. This focus on spatial logic underlines the importance of configuration in reflecting cultural values and daily practices. Seo (2022), in “*Relocating home activities: spatial experiments in Malaysian apartment houses to accommodate the vernacular lifestyle*” and Bellal (2004) in “*Understanding home cultures through syntactic analysis: The case of Berber housing*” have also highlighted how spatial patterns in vernacular houses can serve as a foundation for improving the quality of modern house design, with particular attention to spatial permeability and relational connectivity (Sadanand et al., 2021).

However, shifts in modern house design, now increasingly prioritizing individualism and health, have overlooked the social and cultural symbols integral to vernacular homes (Rapoport, 1969; Saleh, 2008). Understanding and applying design elements from vernacular environments can enrich the concept of modern housing design, making it more responsive to the social and cultural needs of its inhabitants.

In the Southeast Asian context, vernacular housing has been widely recognized for its responsiveness to both environmental and social conditions. Studies across the region have shown that spatial configurations in traditional houses often prioritize permeability, flexibility, and strong indoor–outdoor relationships, which support communal lifestyles and adaptive daily practices (Seo et al, 2022). These characteristics are particularly relevant when examining contemporary housing challenges in rapidly urbanizing regions such as Malaysia.

RESEARCH METHODOLOGY

This study employs diagrammatic analysis using the space syntax approach (Hillier and Hanson, 1984) to investigate the configurational structure of domestic space in house plans. In this approach, spatial configuration is understood as a system of interconnected spaces, where the relationship between spaces is defined not only by their physical adjacency, but by their position within the overall spatial network (Hanson, 1998; Ostwald, 2011).

To operationalize the analysis, each house plan was first translated into a spatial configuration model by identifying individual functional spaces (e.g., living room, kitchen, bedroom) as nodes, and the direct connections between them (e.g., doors, openings, or circulation paths) as links (Figure 1). This transformation enables the representation of spatial relationships as a graph system, allowing the underlying structure of access and movement to be examined beyond geometric form (Hanson, 1998, Bellal 2004; Yahya et al, 2023).

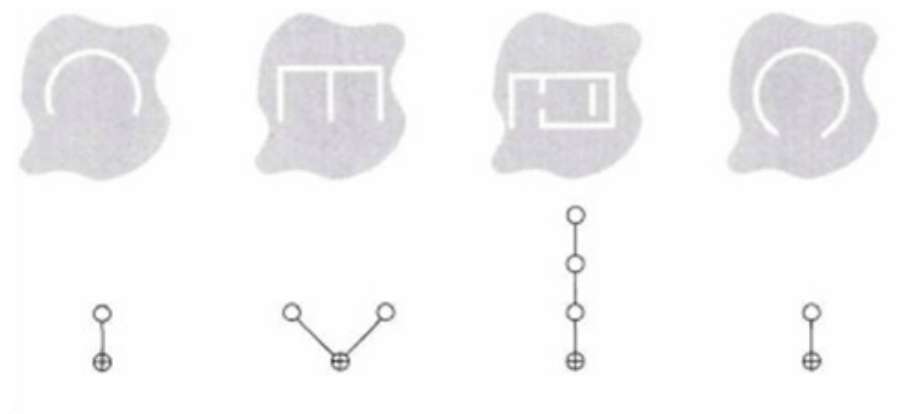


Figure 1: A justified permeability graph (JPG) of four simple vernacular houses.

Source: Hanson (1998)

A justified permeability graph (JPG) was then constructed for each plan by selecting the main entrance as the root space. All other spaces were arranged hierarchically according to their topological distance (depth) from the entrance, following the method established by Hillier and Hanson (1984). This representation allows the spatial system to be analyzed in terms of accessibility, hierarchy, and relational structure.

The analysis focuses on key syntactic measures, namely depth, connectivity, and integration. Depth refers to the number of steps required to reach a space from the root, indicating its relative accessibility. Spaces with greater depth are interpreted as more segregated and private, while spaces with lower depth are considered more integrated and publicly accessible. Connectivity measures the number of immediate links a space has with adjacent spaces, reflecting its potential for interaction and movement. Integration values are used to assess the relative centrality of each space within the overall configuration, indicating how strongly a space contributes to the spatial system as a whole. An example of the transformation from floor plan to justified permeability graph is illustrated in Figure 2, demonstrating how spatial relationships are translated into a configurational representation for analysis.

A justified permeability graph (JPG)

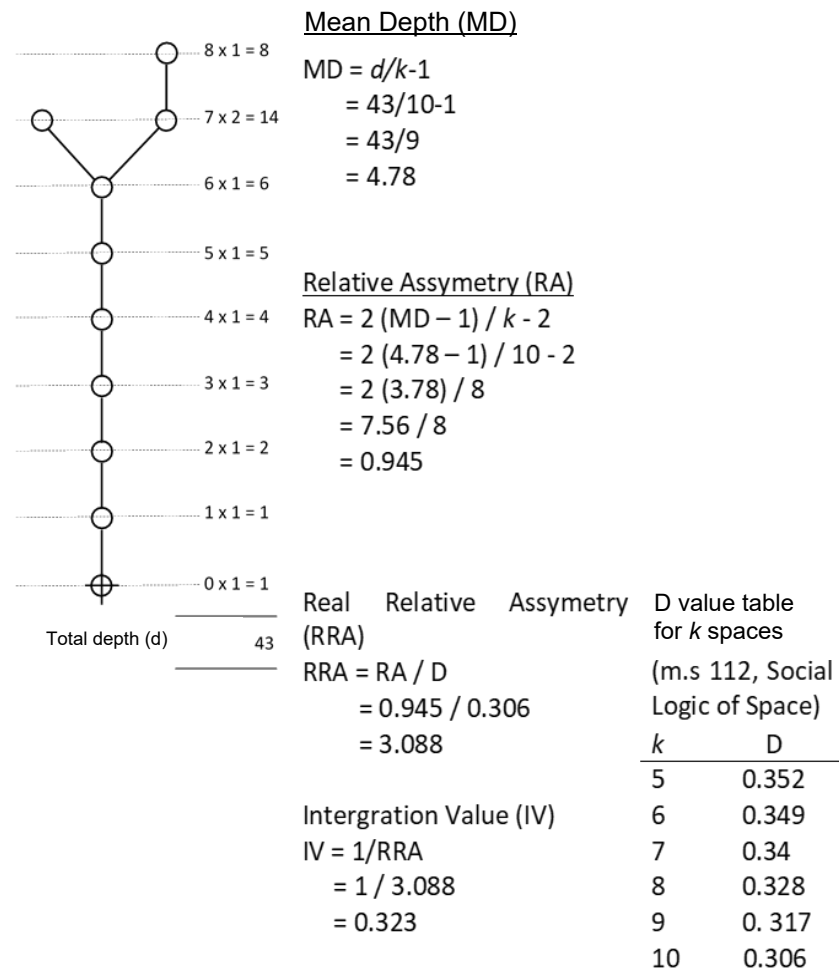


Figure 2: A justified permeability graph (JPG)

Source: Hanson (1998)

These syntactic measures provide a quantitative basis for interpreting the socio-spatial logic embedded within each housing type. Consistent with space syntax theory, variations in depth and integration are understood to reflect cultural patterns of spatial organization, including privacy gradients, gendered

domains, and hierarchical ordering of domestic space (Hillier and Hanson, 1984; Hanson, 1998).

A comparative analysis was then conducted between modern low-cost apartment layouts and vernacular house plans from Peninsular Malaysia. By examining the distribution of shallow and deep spaces, as well as the variation in integration values across plans, the study identifies patterns of continuity, adaptation, or transformation in spatial configuration. This allows for an evaluation of whether contemporary housing retains the underlying socio-spatial logic observed in vernacular traditions.

ANALYSIS AND DISCUSSION

The findings of this study reveal the hidden meanings embedded within the layout design of low-income urban housing when compared to the spatial logic of the Vernacular House. Three key observations have been identified. First, the value of spatial integration reflects a shift in the configuration of social relationships. The Vernacular House features an open network of spaces that supports social connectivity, whereas low-income housing reveals a hidden pattern of segregation beneath its compact and linear arrangement. Second, the topological patterns of access, as mapped through justified graphs, demonstrate a shift in movement logic and spatial reach; low-income housing designs direct users along functional flows, unlike the Vernacular House, which offers flexibility and multiple interpretations of space usage. Third, the hierarchy of domestic space in low-income housing indicates a diminished role for social spaces, reflecting a shift from collective living values to more individualistic frameworks.

Value of spatial integration reflects a shift in the configuration of social relationships

The following graph reveals a significant divergence in spatial integration patterns between Vernacular houses (Rumah Vernakular) and Low-income Urban Housing (Perumahan B40 Perbandaran), indicating a limited influence of vernacular spatial knowledge on the design of low-income urban housing in the Klang Valley (Figure 3). In the vernacular context, the high integration values; particularly in outdoor spaces; suggest an open and interconnected spatial structure, reflecting a system organically shaped by community practices and socio-cultural norms developed in context. In contrast, low-income urban housing demonstrates lower and more homogeneous integration values, characterized by tightly controlled spatial relationships. Zones such as kitchens and toilets appear significantly marginalized, while outdoor areas lose the integrative prominence seen in the vernacular setting.

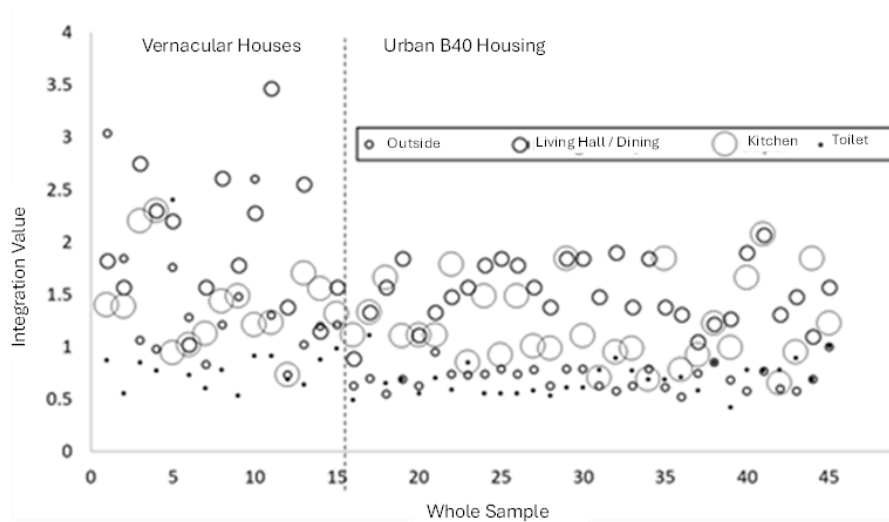


Figure 3: Variation in the consistency of integration values across four core spaces in shaping domestic layout.

Source: Authors.

This pattern suggests that low-income urban housing design is primarily shaped by modern planning approaches grounded in functional segregation, spatial rationality, and standardization, all of which are central to contemporary urban design paradigms. These findings show a growing gap between the spatial design of modern housing and traditional principles, highlighting how some spatial elements may remain connected while others have become increasingly separated.

The topological patterns of access demonstrate a shift in movement logic and spatial reach

The spatial configuration data presented in the table reflects a nuanced relationship between vernacular spatial logic and contemporary urban design in low-income urban housing in Klang Valley (Table 1).

Table 1: Comparison of the relationship between the Outdoor Area, Living Room, and Bedroom with the Kitchen in the Vernacular House (Rumah Vernakular) and low-income urban housing (Perumahan B40 Perbandaran).

Source: Authors.

	THE REMAINING DOMINANT VARIANTS ARE FOUND IN VERNACULAR HOUSES	SHARE VARIANTS	THE REMAINING DOMINANT VARIANTS ARE FOUND IN URBAN B40 HOUSING
FROM OUTSIDE TO KITCHEN			
FROM LIVING ROOM TO KITCHEN			
FROM BEDROOM TO KITCHEN			

JV = VERNACULAR TYPE, JP = URBAN B40 HOUSING TYPE, BT = BEDROOM, RT = LIVING HALL, T = TRANSITION SPACE, D = KITCHEN, KL = OUTSIDE

The presence of shared spatial variants, especially in the flow from the living room and bedroom to the kitchen, suggests that elements of vernacular knowledge such as transitional spaces and open areas remain embedded in urban housing layouts. These patterns suggest a degree of continuity, likely driven by persistent socio-cultural practices that influence household spatial navigation.

However, the emergence of variants exclusive to low-income urban housing, characterized by more direct and linear access routes (e.g., from the bedroom or living room directly to the kitchen), demonstrates a significant departure from the layered and context-responsive configurations typical of vernacular housing. The absence of vernacular-only variants in low-income urban housing, especially those involving open-to-kitchen transitions, further reinforces the inference that modern spatial planning has prioritized efficiency and compactness over environmental responsiveness and cultural tradition. Therefore, the findings suggest that while traces of vernacular spatial logic still remain, the spatial patterns in low-income urban housing are predominantly shaped by contemporary urban design ideologies, which emphasize standardization, space optimization, and modern lifestyle requirements.

The hierarchy of domestic space in low-income housing

Findings from the spatial analysis between the toilet/bathroom (T/M) and kitchen (D) indicate that there is a degree of interaction with vernacular knowledge in the space arrangements of low-income urban housing in the Klang Valley. Certain variants continue to incorporate layered spatial sequences and transitional areas such as the living/dining space (RT/MK), reflecting a continuity of vernacular spatial logic, particularly within the internal organization of domestic space (Figure 4).

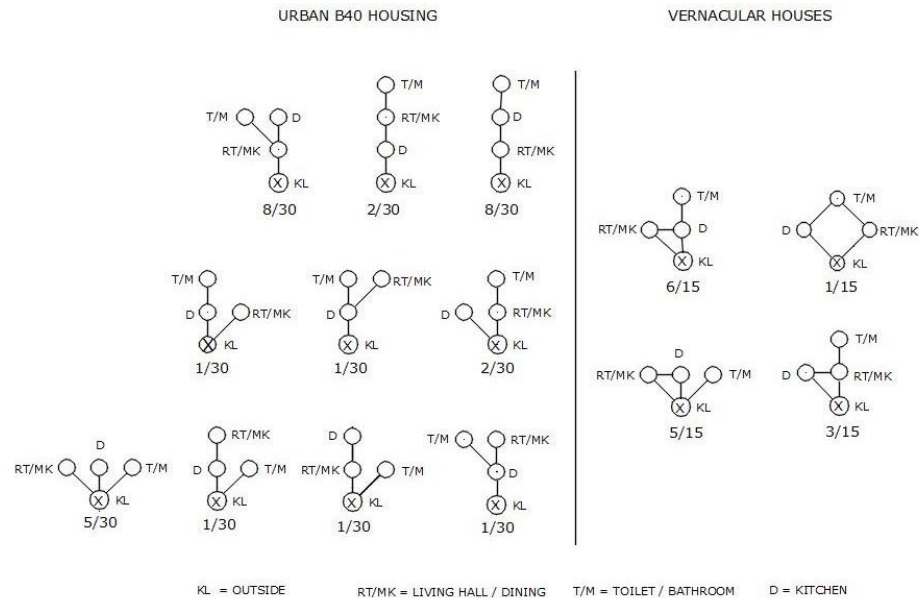


Figure 4: Comparison of basic syntactic patterns for a domestic space containing three social units for the Vernacular House and low-income urban housing.
 Source: Authors.

However, when examined in relation to integration with external areas, low-income urban housing offers more modern and enclosed configurations, reducing the direct relationships between the kitchen and the outdoors, a connection typically found in traditional vernacular houses. This suggests that although domestic layouts in low-income urban housing retain traces of vernacular spatial memory, these have been modified to accommodate urban living requirements and institutional control.

Moreover, the responsibility for ensuring urban life quality has shifted from the community to state-led housing authorities. As a result, modern housing design tends to individualize dwelling units within a uniform complex, diverging from the socially and physically integrated configuration of traditional vernacular settlements. Therefore, this study finds that low-income urban housing exhibits a hybrid spatial character which blends nostalgic domestic experiences rooted in vernacular knowledge with the rational demands of modern urban planning, emphasizing efficiency, control, and standardization.

These spatial patterns are not accidental but are closely linked to contemporary housing policies and socio-economic constraints in Malaysia. The emphasis on standardization, cost efficiency, and high-density development in low-income housing has resulted in compact and controlled spatial

configurations. While such approaches address quantitative housing demands, they often limit the spatial conditions necessary for social interaction, particularly among low-income communities who rely heavily on shared support systems in their daily lives.

For low-income groups, where social support networks are critical for economic resilience and daily survival, the reduction of spatial integration, particularly between domestic and external spaces, may weaken opportunities for informal interaction, mutual support, and community bonding. This suggests that spatial configuration plays a significant role not only in physical living conditions, but also in shaping the social sustainability of urban communities.

CONCLUSION

This study has successfully explored the spatial patterns and design meanings embedded within the spatial configuration of low-income urban housing in Klang Valley, using Vernacular Housing as a cultural and social reference framework. Through a Space Syntax approach, this study has revealed the understanding of how urban housing spaces are organized and function. This study found that although these spaces are designed to meet the needs of modern urban life, elements of traditional social logic are still retained in certain forms. However, these elements have undergone a process of adaptation to align with the more centralized and structured patterns of urban governance. The analysis reveals significant differences between Vernacular Houses and low-income urban housing in terms of spatial configuration. While adaptations have been made to meet modern urban needs and institutional control, the design has not entirely departed from vernacular patterns. Elements such as spatial hierarchy and domestic layout still reflect traces of traditional spatial memory. However, the connection to external spaces has diminished, indicating a shift toward more individualized, standardized, and control-oriented housing models, without fully erasing vernacular social logic.

The transition from community-based spatial structures in vernacular housing to the more individualistic patterns of modern urban dwellings has introduced new challenges within the context of urban living. Modern designs that emphasize physical separation between housing units weaken social interaction and undermine the formation of local communities. This has in turn become a burden for the government in managing urban populations, as the individualistic characteristics evident in urban residential patterns no longer support the strong communal cohesion typically found in rural areas. In rural settings, tribal or kinship-based social structures play a critical role in reinforcing unity to overcome daily challenges. Therefore, the analysis concludes that domestic spatial patterns in urban and rural areas differ as a result of cultural

frameworks shaped by their respective social structures. This study emphasizes the importance of incorporating concepts rooted in local culture into urban housing planning, in order to ensure that modern housing not only addresses contemporary needs, but also upholds the values, norms, and traditions of local communities.

The findings of this study have important implications for contemporary housing policy in Malaysia. Current approaches to low-income housing, which prioritize efficiency, standardization, and cost reduction, tend to produce spatial configurations that limit social interaction and weaken community cohesion. While these strategies are effective in addressing housing shortages, they may unintentionally undermine the social resilience of low-income communities. Future housing policies should therefore move beyond purely quantitative targets and consider the configurational quality of space. This includes designing housing layouts that enhance spatial integration, encourage transitional spaces, and reconnect domestic environments with shared external areas. Such spatial strategies can support stronger social networks, reflecting principles observed in vernacular housing while adapting to contemporary urban constraints. Rather than replicating vernacular forms, the key lies in translating their underlying socio-spatial logic into modern housing design. This approach allows for the development of housing environments that are not only efficient, but also socially responsive and culturally grounded.

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