

ENHANCING INTERIOR SPATIAL QUALITY IN CONFINED DWELLINGS: DESIGNING FOR LOW-COST AND AFFORDABLE HOUSING

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Abstract

Prioritising interior experience is challenging as contemporary culture, and social influences often emphasize exterior views and forms. Previous studies emphasised creating flexible, adaptable spaces and improved tangible dwelling attributes. However, there is a need to explore intangible qualities to enhance living environments in the Klang Valley. This study examines how intangible spatial factors affect residents' well-being in low-cost and affordable high-rise residential buildings. Using a quantitative approach, the study found that lower-income individuals, despite accepting housing within their means, were dissatisfied with the size of homes, leading to adaptations in daily routines and comfort compromises. The study revealed that residents could improve their living conditions by recognising and incorporating intangible spatial aspects, thereby enhancing their overall quality of life.

Keywords: Affordable and low-cost housing, Intangible spatial qualities, Spatial experience.

1. Introduction

Spatial quality is often described as a complex concept as it considers a diverse range of factors that include physical, perceptual, and social features, which are explored from different perspectives by various authors. Though the scope of spatial quality refers to several factors, the main dimension derived from spatial quality is planning [1]. Spatial experience, on the other hand, explains the experience that takes place through one's entire bodily senses and physical movement as one actively interacts with space while moving through it [2]. Experience is composed of three main components: sensation, perception, and conception. Emotions also play an important role and cannot be neglected. Architecture can affect one's sense of being in the world; thus, instead of just vision or the basic five senses, there are several other realms of sensory experience that confluence to truly define one's spatial experience [2].

There are several studies done on the topic of spatial experience; one of them, conducted by Lee [2] explored a phenomenological understanding of interior space with an emotional connection between the user's experience and their space. Soltani and Kirci [3] conducted a similar exploration of interrelating space with phenomenology, with components deriving from experience, sensation, and meaning. While there are more studies done on spatial experience in architecture in general, only a handful have explored the direction of spatial experience in residential buildings, specifically in high-rise residential buildings. The rise of criticisms of existing "shoebox" apartments is developing, and while it proves that this direction of typology lacks spatial quality, the bigger impact is the loss of significant ties to the occupants, which are largely irrelevant to their location [4].

The modern discovery of the intimate interior experience in architectural design emphasised the importance of evaluating works based on the quality of their inhabitants' spatial encounters. However, in the current era, the focus on exterior views and contemporary cultural influences has led to a neglect of the value of the interior experience [5]. The Human Rights Commission of Malaysia issued a critique in 2003, highlighting that while the Malaysian government had focused on officially planning and implementing low-cost housing schemes for the underprivileged, it had neglected to address crucial concerns regarding habitability, suitability, defects, shoddy workmanship, insufficient maintenance, and the physical safety of the occupants [6].

A resident living in a low-cost apartment seeks solace from the constraints of their confined living spaces by taking bicycle rides to Dataran Merdeka, where they find respite and leisurely spend time enjoying the open air, momentarily escaping the constraints of narrow quarters and overcrowded rooms that are characteristic of their daily lives [7].

In addition, due to the limited size of available space and the high cost of larger units, individuals are faced with the challenge of compromising on their housing preferences due to pricing constraints [8]. Furthermore, the poor design quality of low-cost houses in Malaysia is highlighted by their affordability and short construction time, with neglect of regional climate considerations and residents' satisfaction. At the same time, previous research has overlooked the importance of architectural design and spatial planning on occupant well-being [9].

Thus, the study aims to investigate the theories and attributes based on intangible factors such as materiality, axiality, enclosure, spatial figure, daylight,

and spatial organisation that impact residents with the notion of improving interior spatial quality in high-rise low-cost, and affordable residential buildings.

The challenge addressed in this paper is understanding if there is a potential implementation of intangible factors in confined spaces. There is a need to establish a further understanding of the relationship between these two areas, and this study responds to the research question as follows: Does the reliability of intangible spatial qualities such as materiality, axiality, enclosure, spatial figure, daylight, and spatial organisation compensate for or complement the constraint of space experienced by residents in low-cost or affordable residential buildings in Klang Valley?

2. Literature Review

The literature emphasises spatial and intangible elements in architectural design and housing, yet there is a research vacuum in incorporating these into Malaysia's inexpensive home design guidelines. Current recommendations emphasise physical characteristics such as room sizes while ignoring the psychological, emotional, and social qualities of spatial experience that are critical for residents' well-being. Future studies should focus on developing guidelines that take into account these intangible features in order to create more inclusive living conditions for low-income households.

2.1. Spatial experience

Spatial experience can be described as having a physical, sensory, and mental effect on an individual who's experiencing walking through a space, while the term 'experience' refers to the body as a medium used to interact with space and objects that create an emotional aspect. The importance given to spatial experience can be seen as highlighted by several architects and designers by engaging with a few issues such as materiality, senses, body, emotion, and environment [2].

Since space is influenced and shaped by the experiences of its users, it is expressed through psychological and philosophical encounters. Space is also regarded as the architect's "work" and serves as a conduit between the producer (the architect) and the customer (the inhabitant). Therefore, it is essential to develop a framework for comprehending these three conflicting axes [10].

2.2. Intangible spatial qualities

The non-measurable qualities of space are a broad topic with factors that have a wide range of interpretations from one person to the next. However, it is believed that seven factors would make up a systemic design specifically for dwelling spaces, which leads to the idea of creating a sense of non-measurable qualities in the setting of a dwelling: materiality, axiality, movements, spatial figure, daylight, and organisation of spaces [11]. People tend to get attached to their dwelling spaces, making the perception and experience of space a function of the space-time continuum [12]. He added on to mention that the meanings and characters connected with the use and experience of the space through the variety of activities in the context of cultivation describe and define the space for the user.

Moreover, the identification of spatial qualities with a focus on the dwelling space organisation, which comprises understanding the space through the interconnection between perception, memories, previous experience, and opportunities for embraced actions within the potential space. Rapoport, in 2016, also shares similar views and ideologies towards intangible spatial qualities as

Ebrahimi by mentioning a few factors that contribute to these non-measurable qualities, such as previous experience, adaptation, memory, cognition, and culture.

2.3. Relevant studies within the Malaysian context

Several studies have been conducted to enhance the living environment of residents through various aspects of design within the context of Malaysia. Yahya et al. [13] explored the perspectives of low-income individuals on how they utilised limited space for dwelling. The study critiqued previous research methods used to understand low-income individuals' perceptions of domestic space and proposed a creative approach to illustrate their ideal homes based on their viewpoints.

By considering the hierarchy of integrated space functions, unnecessary spaces such as transition areas could be reduced to create more meaningful spaces based on their intended functions. This research provided valuable insights into the spatial characteristics informed by the opinions of low-income individuals. It not only presented layout plans but also proposed diagrammatic concepts that architects' design intuition could further develop to achieve improved housing solutions for low-income communities [13].

Ismail et al. [9] explored a study to measure the quality of life in low-cost residential environments managed by City Hall Kuala Lumpur (CHKL). They found that residents' satisfaction with the residential environment impacts their overall quality of life. Residents were content with the existing low-cost public developments, indicating effective management.

However, in terms of physical elements, residents expressed higher satisfaction with aspects such as ventilation, lighting, rent management, garbage management, and electricity supply. The study concludes that a combination of objective and subjective indicators can be used to measure the quality of life in public low-cost flats, enabling local governments to create more comfortable homes and improve residents' well-being through proper management of housing developments and schemes.

2.4. Design guidelines-affordable and low-cost high-rise residential buildings

The literature includes current design standards and guidelines set regarding the design of affordable as well as low-cost high-rise residential buildings in Malaysia. The Construction Industry Development Board (CIDB) of Malaysia has developed an affordable housing standard that is intended to serve as a reference and guideline as shown in Fig. 1. for the construction industry's players in affordable housing development. Moreover, despite the attention given to the number of rooms in the units, there are discussions regarding the overall size of the affordable housing units. Some critics argue that the size of these units remains underwhelming, which can impact the comfort and functionality of the living spaces. It is important to strike a balance between affordability and liveability, ensuring that the units are spacious enough to accommodate residents' needs while keeping construction and maintenance costs within the affordable range.

In line with the objective of providing affordable and quality housing, the Malaysian government has implemented a housing strategy of Pricing System for Public Housing (PPR) schemes that focuses on constructing low-cost housing as shown in Fig. 2. specifically targeted at lower-income groups [6]. However, it is important to

acknowledge that these guidelines, although well-intentioned, sometimes fail to consider the specific family contexts of the individuals who will be residing in these units. The stringent size requirements tend to provide minimal living space, often disregarding the diverse needs and circumstances of lower-income households.

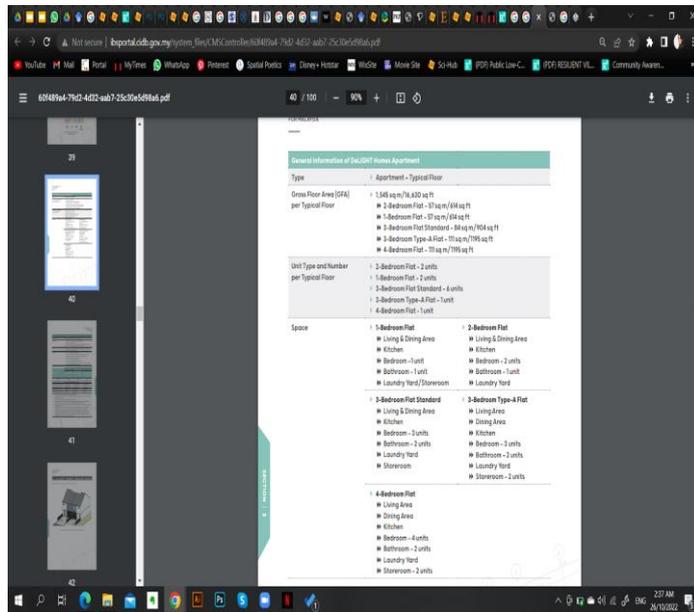


Fig. 1. Design guidelines for affordable housing units in Malaysia.
(Source: The Construction Industry Development Board)

Element	Terrace Houses	Flats
Floor space	48-60 m ²	45-56 m ²
Bedroom		
Minimum number and minimum area of habitable room	3	3
1 st room	11.7 m ²	11.7 m ²
2 nd room	9.9 m ²	9.9 m ²
3 rd room	7.2 m ²	7.2 m ²
Kitchen	4.5 m ²	4.5m ²
Living and dining rooms	Provided as one combined space or separated with adequate area according to internal layout.	Provided as one combined space or separated with adequate area according to the internal layout
Bedroom and toilet	Provided separately with a minimum area of 1.8 m ² each.	Provided separately with a minimum area of 1.8 m ² each.
Storage space and porch	Adequate provision for resident's comfort.	Adequate provision for resident's convenience and comfort.
Drying area	-	Adequate provision for each unit.
(*) Launderette facilities		

Note: (*) Must be provided according to the Guidelines for the provision of launderette facilities in multi-storey building” prepared by Local Department.

Sources : Ministry of Housing and Local Government (1998)

Fig. 2. Design guidelines for low-cost housing units in Malaysia.
(Source: Ministry of Housing and Local Government)

The design standards for affordable and low-cost housing in Malaysia prioritize the physical aspects of the dwelling, particularly the size requirements for each space within the unit, as depicted in Fig. 1. and Fig. 2. However, these standards overlook factors beyond functional necessities, which are the main focus of this study. While cost considerations and market value cannot be disregarded, there is still a need to explore potential design standards that address spatial needs. Therefore, this study

aims to highlight the importance of considering additional elements that enhance the overall well-being and quality of life for residents in affordable housing, including the social and emotional aspects of their living environment.

2.5. Theoretical Framework

Figure 3 illustrates the comprehensive framework employed in this study, which places particular emphasis on the non-measurable and intangible factors that play a crucial role in enhancing the interior spatial qualities of dwellings. This study specifically focused on low-cost and affordable housing, aiming to investigate and validate the proposed theory in this particular setting.

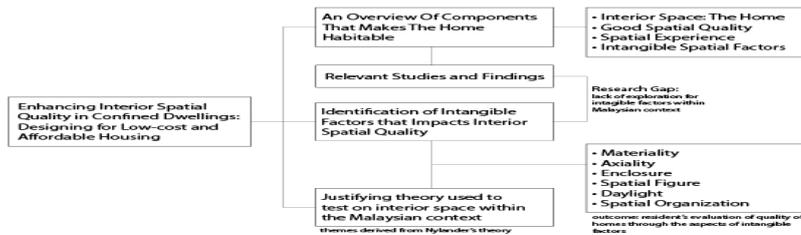


Fig. 3. Theoretical framework (Author, 2023).

3. Methods

This research investigated the theories and attributes based on intangible factors that impact residents with the notion of improving interior spatial quality in high-rise low-cost, and affordable residential buildings. This research used quantitative research method, as similar studies are commonly based on case studies.

3.1. Sample of research

This study aims to investigate the perspectives of residents living in two types of high-rise housing typologies, which include low-cost and affordable housing. The research was conducted in the Klang Valley area, which has experienced significant growth in high-rise residential buildings.

The housing units considered for this study range in size from 600 square feet to 950 square feet, adhering to the existing guidelines for low-cost and affordable housing. According to the NAPIC Property Stock Report, 2021 [14], the estimated housing supply in the Klang Valley is 2.1 million. However, affordable housing comprises only a quarter of the overall existing stock, and within that subset, a small portion relates to the focus of this study, namely high-rise buildings.

This study, despite the common practice of employing a sample size of 100 participants in quantitative research, received an unexpectedly high response, totalling 114 participants. This surplus allows for a more comprehensive exploration of the perspectives and experiences of residents living in high-rise housing, offering a nuanced understanding of the challenges and advantages associated with this housing typology. The respondents of this study, all aged 20 years and above, are poised to provide invaluable insights and experiences concerning their residency in high-rise housing within the Klang Valley area. This diverse group encompasses individuals from various socio-economic backgrounds, occupations, and family structures.

3.2. Instrument of research

The quantitative research method utilises survey questionnaires as the medium to answer the research questions of this study, as it allows obtaining information about a given phenomenon through the formulation of questions that reflect the opinions, perceptions, and behaviours of a group of individuals.

The survey questionnaire is validated following the literature review to address the research question, with the questionnaires consisting of quantitative data. The set of questions was categorised into three parts: Part A, B, and C as shown in Table 1. Part A consists of the resident's demographic data, and part B comprises questions in regard to the inhabitant's perspective and importance given to intangible spatial qualities on a 5-point Likert scale from very unimportant to very important. Part C consists of two sub-portions, both answering the existing spatial qualities in the inhabitant's current living environment, with part C (I) covering the question on existing tangible spatial qualities with a 5-point quality Likert scale and part C (ii) with questions on the existing intangible spatial qualities with a 5-point satisfaction Likert scale.

Table 1. Mapping of instruments to study the research.

Survey Questionnaire	Question Number	Research Question
Section A		
Demographic information	Q1 - Q5	
Section B		
Resident's perspective and importance towards intangible spatial quality	Q6 – Q11	RQ1
Section C (I)		
Residents' evaluation of existing tangible spatial qualities	Q12 – Q23	RQ2
Section C (II)		
Residents' evaluation of existing intangible spatial qualities	Q24 – Q29	RQ2 and RQ3

3.3. Data collection procedure

The survey questionnaires were designed using Google Forms and distributed online through Google Form links. The target participants for this study were residents living in low-cost and affordable high-rise residential buildings within the Klang Valley area. Specifically, the survey was shared with residents of Pangsapuri Serunai in Bukit Raja Klang, Pangsapuri De Kiara in Bandar Setia Alam, PPR Lembah Subang 2, as well as Residensi Medan in Petaling Jaya. To enhance respondents' understanding of the study, a description of each intangible spatial quality was provided before each section of questions in the questionnaire. These descriptions aimed to effectively convey the elements being tested and provide clarity to the respondents as they proceeded through the survey.

The data collection for this study was conducted through an online survey using Google Forms. The collected data is readily available and can be seamlessly transferred into technical statistical software or spreadsheets for in-depth analysis. Additionally, respondents who have internet access tend to prefer online surveys, as they can conveniently choose a time that suits them best, and the required time to complete the questionnaire is significantly shorter. This convenience factor contributes to higher participation rates and improved data quality. Each piece of

information obtained from the survey was given a unique number from 1 to 5, which is then used to develop a codebook for data entry into the Statistical Package for Social Sciences version 29 (SPSS v. 29) software.

Upon entering the data into SPSS v. 29, through the medium of descriptive analysis, frequency distribution statistics were generated to obtain a profile of the respondents. Furthermore, descriptive analysis was also used to produce the central tendency statistics for further discussion of the study.

3.4. Data analysis

This research is approached with a quantitative research method using a designed survey questionnaire. The frequency distribution and central tendency statistics of all variables examined in this research were analysed and compared. This comprehensive analysis served as a basis for generating further discussion and ultimately drawing conclusions to conclude the research.

3.5. Descriptive statistics of demographic profile

Descriptive statistics organise and present the characteristics or factors of a sample using numerical procedures and graphical techniques (Fisher & Marshall, 2009). Frequency distribution involves presenting or summarising grouped data by categorising it into distinct and non-overlapping classes and then representing the number of occurrences within each class, thus presenting the demographic profile of the respondents.

3.6. Descriptive statistics of mean Score and standard deviation

The data collected for this research was analysed using SPSS version 29. Descriptive statistics, such as mean scores and standard deviations, were used to calculate the central tendency and variability of the variables studied. The mean scores provide insight into the average value or level of each factor that residents consider important in their homes. The standard deviations indicate the degree of dispersion or spread around the mean, revealing the variability in residents' preferences.

4. Research Findings

4.1. Descriptive analysis of study of respondents

The first section of the survey questionnaires demonstrates the respondents' demographic data as shown in Table 2, with the analysis based on a total of 114 responses.

The purpose of collecting the demographic data is to understand if there is a relationship between the demographic data and how the spatial qualities are perceived and acknowledged. The study comprises 43% male respondents and 57% female respondents, ranging in age from 20 to above 60 years old.

The data on the respondent's employability status is also collected to observe if their period of staying at home affects their perspective or preference of their living environment, and from the overall data, 40 of the respondents are unemployed, 71 of the respondents are employed, and the remaining 3 are retirees. For 55% of the respondents, the number of occupants in the household is between 1 to 2, while 45% of the respondents have a household composition of between 3 to 4 individuals.

Table 2. Demographic data of survey respondents.

		Frequency	Percentage (%)
Gender	Male	49	43
	Female	65	57
Age	20 – 29	21	18
	30 – 39	38	33
	40 – 49	40	35
	50 – 59	11	10
	60 and above	4	4
Employment Status	Unemployed	40	35
	Employed	71	62
	Retired	3	3
Household Composition	1 – 2 persons	63	55
	3 – 4 persons	51	45

Note sample size N= 114.

4.2. Perspective of intangible spatial qualities

The participants were asked to rate the importance of each intangible spatial quality on a 5-point Likert scale, ranging from "very unimportant" to "very important." Table 2 presents the analysis detailing the significance of each intangible spatial quality. Analysis in Table 3 reveals that 30% of respondents deemed materiality "very important," 50% considered it "important," and 20% expressed a neutral standpoint. Axiality, which pertains to the arrangement of spaces in terms of hierarchy and movement, was regarded as valuable by 100% of respondents, with 40% describing it as "very important" and the remaining 60% labelling it as "important."

Table 3. Perspective of inhabitants toward intangible spatial qualities.

Intangible Spatial Qualities	Importance	N	Percentage (%)
Materiality	Neutral	23	20
	Important	57	50
	Very Important	34	30
Axiality	Important	68	60
	Very Important	46	40
Enclosure	Important	79	69
	Very Important	35	31
Spatial Figure	Neutral	19	17
	Important	75	66
	Very Important	20	17
Natural Lighting	Important	68	60
	Very Important	46	40
Spatial Organization	Important	20	17
	Very Important	94	82

Regarding enclosure, which influences privacy and territorial control within dwellings, 31% of participants deemed it "very important," while the remaining 69% described it as "important." The spatial figure, representing the proportional factor of the dwelling unit, was found to be significant by over 80% of respondents. Among them, 17% regarded it as "very important," 66% as "important," and 17% maintained a neutral stance.

All respondents recognised the importance of natural lighting, with 40% considering it "very important" and the remaining 60% perceiving it as "important." Spatial organization, which encompasses the balance between private and public spaces within dwellings, was valued by all participants. Specifically, 82% regarded it as "very important," while 17% labelled it as "important."

4.3. Quality of existing tangible spatial qualities

Table 4 provides an overview of the identified quality ratings for tangible spatial qualities in different areas of the dwelling, such as the living room, dining room, kitchen, and bedroom.

The data analysis is structured by dividing it into four dwelling spaces, followed by factors pertaining to tangible spatial qualities. The living room, serving as a pivotal gathering point within the dwelling, received a rating of a comfortable size from just over 50% of respondents, while approximately 30% expressed satisfaction with the layout of the space.

Over 80% of participants described the quality of materials in their living rooms as good. The dining area, also significant as a gathering space at various times of the day, garnered a positive size rating from just over 50% of respondents. However, some perceived it to be underwhelming, with 20% describing the size of the dining space as poor. Nonetheless, nearly 80% of participants evaluated the layout and material quality of their dining rooms as good.

In terms of the kitchen space, respondents assigned it one of the lowest ratings. Only 30% considered the size of the kitchen to be good, while slightly over 20% described the layout as good. On the other hand, over 70% of participants regarded the quality of materials in their kitchens as good.

Similarly, the size of the bedroom space received a good rating from nearly 20% of respondents, while just over 30% perceived the layout as good. However, almost 80% of participants expressed satisfaction with the material quality in their bedrooms.

4.4. Satisfaction of existing intangible spatial qualities

The findings presented in Table 4 demonstrate the evaluation of materiality, axiality, enclosure, spatial figure, natural lighting, and spatial organisation.

Similar to the assessment of material quality in tangible spatial qualities, more than 70% of respondents expressed satisfaction, while 26% deemed it "acceptable." Regarding axiality, 32% of respondents expressed satisfaction with the axial arrangement within their dwellings, while 68% deemed it "acceptable."

The majority of participants indicated contentment with the enclosure of their dwellings, with 77% rating it as "satisfied" and the remaining 23% rating it as "very satisfied."

When evaluating the spatial figure of their units, 80% of respondents expressed fulfilment, while 20% deemed it "acceptable." The data regarding natural lighting revealed that all respondents were pleased with the presence of natural light in their dwellings, with over 81% expressing satisfaction and 19% indicating they were "very satisfied."

The respondents also conveyed their contentment with the spatial organisation within their respective units, with 64% stating they were "satisfied" and the remaining 36%

responding with "very satisfied." Satisfaction of existing intangible spatial qualities in the current residing units is shown in Table 5.

Table 4. Quality of existing tangible spatial elements in the current unit respondents reside in.

Tangible Spatial Qualities	Spaces	Quality	N	Percentage (%)
Size of Spaces	Living Room	Poor	26	23
		Acceptable	24	21
		Good	35	34
		Very Good	29	25
	Dining Room	Poor	23	20
		Acceptable	31	27
		Good	38	34
		Very Good	22	19
Layout of Space	Kitchen	Poor	27	24
		Acceptable	52	46
		Good	35	30
	Bedroom	Poor	32	28
		Acceptable	61	54
	Living Room	Good	21	18
		Acceptable	85	75
	Dining Room	Good	29	25
		Poor	26	23
	Kitchen	Good	52	46
		Very Good	36	31
	Bedroom	Poor	32	28
		Acceptable	58	51
	Living Room	Good	24	21
		Acceptable	74	65
	Dining Room	Good	40	35
Acceptable		28	25	
Kitchen	Good	86	75	
	Acceptable	24	21	
Bedroom	Good	90	79	
	Poor	11	10	
Living Room	Acceptable	18	16	
	Good	85	74	
Dining Room	Poor	6	5	
	Acceptable	22	19	
Kitchen	Good	86	76	

Table 5. Satisfaction of existing intangible spatial qualities in the current residing units.

Intangible Spatial Qualities	Satisfaction	N	Percentage (%)
Materiality	Acceptable	30	26
	Satisfied	65	57
	Very Satisfied	19	17
Axiality	Acceptable	78	68
	Satisfied	36	32
Enclosure	Satisfied	88	77
	Very Satisfied	26	27
Spatial Figure	Acceptable	23	20
	Satisfied	76	67
	Very Satisfied	15	13
Natural Lighting	Satisfied	92	81
	Very Satisfied	22	19
Spatial Organization	Satisfied	73	64
	Very Satisfied	41	36

5. Discussion

The research aims to investigate the theories and attributes based on intangible factors that impact residents, with the goal of improving interior spatial quality in high-rise low-cost and affordable residential buildings. The key findings reveal several important insights.

5.1. Resident's primary perspective towards intangible spatial qualities

Among the factors as shown in Table 6 examined, spatial organisation emerged as the most significant ($M = 4.82$, $SD = 0.382$), indicating that residents attribute great importance to the arrangement of spaces within a dwelling. They possess a comprehensive understanding of the relationships between these spaces, contributing to their heightened valuation of this aspect.

Table 6. Importance of intangible factors to residents.

	Factors	Minimum	Maximum	Mean	Std. Deviation
PSQ1	Materiality	3.00	5.00	4.10	0.704
PSQ2	Axiality	4.00	5.00	4.40	0.493
PSQ3	Enclosure	4.00	5.00	4.31	0.463
PSQ4	Spatial Figure	3.00	5.00	4.01	0.587
PSQ5	Natural Lighting	4.00	5.00	4.40	0.493
PSQ6	Spatial Organization	4.00	5.00	4.82	0.382

Note: Sample Size $N = 114$

Conversely, spatial figure, which pertains to the proportioning of space, received the lowest rating ($M = 4.01$, $SD = 0.587$). This may be attributed to the fact that housing units often adhere to standardised proportions, such as prescribed room heights and minimum room sizes. Consequently, residents may perceive this factor as less important due to its limited variability in practice.

It is noteworthy that the mean values for all the factors fell within the range of 4.00 to 4.99, signifying a relatively high level of importance. This suggests that these factors are significant considerations for residents when seeking an ideal housing unit, indicating their preferences and priorities in this regard.

5.2. Residents' description of tangible qualities presents in their dwelling

The results as shown in Table 7 depict the evaluation of tangible factors for each core space within the dwellings. When considering the size of the space, the living room received the highest level of satisfaction from residents, with a mean value of 3.59 ($SD = 1.104$). On the other hand, the bedroom obtained the lowest satisfaction level ($M = 2.90$, $SD = 0.678$). These ratings can be attributed to the specific space requirements necessary for residents to carry out their daily routines.

The living room may serve as a central gathering place for families during specific times of the day. As the space is designed to accommodate small families, the majority of residents expressed contentment with the allocation of space for their living area. However, the bedrooms may be perceived as inadequate by residents due to various factors.

Table 7. Evaluation of tangible factors existing in residents' dwelling.

Spaces	Factors	Minimum	Maximum	Mean	Std. Deviation
Living Room	Size of Space	2.00	5.00	3.59	1.104
	Layout of Space	3.00	4.00	3.25	0.437
	Quality of Material	3.00	4.00	3.75	0.432
Dining Room	Size of Space	2.00	5.00	3.53	1.015
	Layout of Space	2.00	5.00	3.86	1.104
	Quality of Material	3.00	4.00	3.79	0.409
Kitchen	Size of Space	2.00	4.00	3.07	0.737
	Layout of Space	2.00	4.00	2.93	0.700
	Quality of Material	2.00	4.00	3.65	0.651
Bedroom	Size of Space	2.00	4.00	2.90	0.678
	Layout of Space	3.00	4.00	3.35	0.479
	Quality of Material	2.00	4.00	3.70	0.563

Note: Sample Size N = 114.

For instance, families with a growing number of members may find it challenging to adapt to sharing and dividing themselves within a three-bedroom apartment. Furthermore, if family members are working from home, the function of the bedroom may need to extend beyond sleeping, potentially serving as an office space. Similarly, children requiring a dedicated area for studying may find the allocated space within the bedroom insufficient for their needs. These considerations contribute to residents' lower satisfaction levels when evaluating the size of their bedrooms. The evolving functions and increasing demands placed on the bedroom space, along with the expanding family size, may contribute to a perceived lack of adequate space.

5.3. Residents' acknowledgment of intangible qualities in their dwelling

From the results obtained in Table 8, it is evident that the respondents found a slight comfort in their living space, as the overall mean value has a higher rating as compared to the results of tangible factors in Table 8. Intangible spatial factors consider the standpoint of the occupants in the space and how they utilise, navigate, customise, and carry out their routines in accordance with their preferences. The residents are seen to be most satisfied with the spatial organisation within their dwelling, with a mean value of 4.36 (SD = 0.482), while they are least satisfied with the axiality in the dwelling (M = 3.32, SD = 0.467).

The spatial organisation encompasses the arrangement and layout of rooms and circulation patterns within a home, with a particular focus on how interior spaces intersect and connect the private and public areas. Analysis of the results in Table 8 reveals that residents are generally satisfied with the spatial organisation of their dwellings.

Table 8. Evaluation of intangible factors existing in residents' dwelling.

	Factors	Minimum	Maximum	Mean	Std. Deviation
ISQ1	Materiality	3.00	5.00	3.90	0.651
ISQ2	Axiality	3.00	4.00	3.32	0.467
ISQ3	Enclosure	4.00	5.00	4.23	0.421
ISQ4	Spatial Figure	3.00	5.00	3.93	0.576
ISQ5	Natural Lighting	4.00	5.00	4.19	0.396
ISQ6	Spatial Organization	4.00	5.00	4.36	0.482

Note: Sample Size N = 114.

This satisfaction may stem from the comfort and sense of privacy experienced by the residents while occupying their homes. For instance, a resident working from home in their bedroom may find that despite being dissatisfied with the allocated size of the bedroom ($M = 2.90$, $SD = 0.678$), as evident in Table 8, the presence of a window offering a great view of the city or greenery enhances their comfort and productivity.

Additionally, respondents expressed a neutral sentiment about the size of the kitchen ($M = 3.07$, $SD = 0.737$), as indicated in Table 8. However, the placement of the kitchen facing the corridor with a view of their neighbours may facilitate opportunities for communication, thereby enhancing the residents' overall mood and contributing to a better daily routine.

Axiality refers to the way that spaces in a home connect from a central point, often referred to as the "heart" of the house. However, different inhabitants may have different opinions on what constitutes the central part of their home. For example, those who work from home may consider their office or bedroom to be the central space, while a family may view the dining room as the heart of the home, where they gather for meals. In the first scenario, when a different purpose is given to the space, it may lead to confusion in creating boundaries within the home, but once established, as in the second scenario, the heart of the home becomes more relevant.

From the results in Table 8, it seems that the inhabitants feel neutral towards the axiality of their home; this may be due to the lack of establishment mentioned since high-rise residential properties within the low-cost and affordable range tend to have a standardised layout of spaces.

6. Conclusion

In the contemporary architectural scene of Malaysia, high-rise residential buildings tend to prioritise the visual appeal of their exteriors while overlooking or regarding the interior spatial quality as purely functional space. This oversight extends to the allocation of space within these buildings, raising concerns. Existing research predominantly concentrates on low-cost and affordable high-rise residential buildings in Malaysia. These studies emphasise the importance of incorporating adaptable and flexible spaces, enabling effective space utilisation, and enhancing other tangible aspects of the living environment.

However, in the past, there was a dearth of research exploring alternative factors that incorporate intangible attributes to address space limitations and enhance the quality of the living environment and dwelling spaces. This led to the question of whether interior spatial quality could be regarded as a guiding design principle that prioritises residents' spatial experience within confined high-rise residential units, particularly in the context of low-cost and affordable housing.

Intangible spatial qualities refer to the ways in which space is shaped, organised, and structured to create a sense of place and to facilitate specific activities and interactions. These immeasurable qualities serve as crucial elements in crafting spaces that are both functional and liveable while also reflecting the social and cultural circumstances of the residents. Building upon Nylander's theory on intangible spatial qualities, this study aimed to examine whether residents residing in low-cost and affordable high-rise residential buildings in Malaysia would respond to these factors with a comparable level of significance as posited in Ola Nylander's theory.

The study revealed that lower-income residents, although they accepted housing options aligned with their income, expressed discontentment regarding the size of their homes. This situation forced them to adjust their routines and sacrifice comfort. However, as highlighted in the research findings, these residents exhibited the capacity to enhance their living conditions by acknowledging the importance of intangible spatial qualities. They accomplished this by personalising and altering their homes within their means, ultimately elevating their overall living experience.

7. Recommendations for Future Research

This study reveals the significance of intangible spatial qualities in architecture, highlighting their equal importance alongside tangible spatial qualities and suggesting opportunities to extend the architectural experience beyond the physical realm. It also promotes further exploration of user-centred design approaches in low-cost and affordable high-rise residential buildings, emphasising the inclusion of residents in the design process to enhance satisfaction and well-being through the incorporation of their preferences and needs for intangible spatial qualities.

Additionally, the study calls for investigations into the influence of cultural factors on residents' perception and utilisation of these intangible spatial qualities to understand potential cultural variations in how residents personalise and modify their living spaces and the implications for design practises.

Furthermore, it underscores the need for additional research to examine the policy implications of these findings, particularly in terms of housing affordability and spatial quality, and explores how government policies and regulations can be revised or developed to prioritise intangible spatial qualities, ensuring that low-cost and affordable housing units provide satisfactory living conditions for residents. Overall, the study emphasises the importance of intangible spatial qualities, encourages user-centred design, incorporates cultural considerations, and advocates for policy revisions that prioritise both affordability and spatial quality in housing.

References

1. Acre, F.; and Wyckmans. A. (2014). Spatial quality determinants for residential building renovation: A methodological approach to the development of spatial quality assessment. *International Journal of Sustainable Building Technology and Urban Development*, 5(3), 183-204.
2. Lee, K. (2022). The interior experience of architecture: An emotional connection between space and the body. *Architecture: Integration of Art and Engineering*, 12(3), 326.
3. Soltani, S.; and Kirci, N. (2019). Phenomenology and space in architecture: Experience, sensation, and meaning. *International Journal of Architectural Engineering Technology*, 6, 1-5.
4. Shepherd, J. (2014). Interlocking: The phenomenological apartment. Retrieved November 14, 2021, from <http://hdl.handle.net/10063/3464>.
5. McCarter, R. (2016). The space within: Interior experience as the origin of architecture. Reaktion Books. Retrieved November 15, 2016, <https://www.perlego.com/book/777139/the-space-within-interior-experience-as-the-origin-of-architecture-pdf>

6. Goh, A.T.; and Yahaya, A. (2011). Public low-cost housing in Malaysia: Case studies on PPR low-cost flats in Kuala Lumpur. *Journal of Design and Built Environment*, 8 (1), 1-18.
7. Cheong, S. (2023). Sustainable solution for urban living. Star Media Group Berhad. Retrieved September 5, 2023, from <https://www.thestar.com.my/lifestyle/travel/2023/08/29/sustainable-solution-for-urban-living>
8. Tong, K.O. (2023). Malaysian residential properties have become more, not less, affordable. The Edge Publishing Pte Ltd. Retrieved July 5, 2023, <https://www.theedgesingapore.com/capital/tongs-portfolio/malaysian-residential-properties-have-become-more-not-less-affordable>
9. Ismail, A.S.; Mohidin, H.H.B.; and Daud, M.M. (2017). A review on occupants' satisfaction and wellness level in low-cost housing in Malaysia. *Planning Malaysia Journal*, 15(3), 147-158.
10. Salman. (2016). *Immateriality in architecture: The users' spatial experience in the context of Bahrain*. Ph.D. Thesis. University of Brighton, England.
11. Nylander, O. (2007). Architecture of the home. Building Design Department - Chalmers University of Technology. Retrieved January 31, 2022, from https://research.chalmers.se/publication/912/file/912_Fulltext.pdf
12. Ebrahimi, P.R. (2013). *Notes on perceptual qualities of space: Dwelling spatial organization*. Master's Thesis, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ), Northern Cyprus.
13. Yahya, A.S.; Ahmad, M.H.; and Hassan, A.A.G. (2023). Pentafsiran sosial reka bentuk ruang domestik di Lembah Kelang, Malaysia. *Pertanika Journal of Social Sciences and Humanities*, 31(3), 1245.
14. Property Stock Report. (2021). Pusat Maklumat Harta Tanah Negara (NAPIC). Valuation and Property Services Department. Ministry of Finance Malaysia. Retrieved July 5, 2023 <https://napic2.jpjh.gov.my/storage/app/media/3-penerbitan/inventori/2021/1648827864958LaporanStokHartaTanah2021.pdf>