

TOWARDS HUMANE DESIGN OF HIGH-RISE RESIDENTIAL BUILDINGS IN NORTHERN GUANGXI

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Abstract

In the age of globalisation, the design of modern high-rise residential spaces often prioritises mass production over consideration of the end-user's living habits, cultural traditions, activity patterns, and needs. As a result, residents often lack community identity and a sense of belonging, leading to poor quality of life and negative physical and mental health impacts. To address this issue, this study aims to explore ways to make the indoor spaces of high-rise residential buildings in northern Guangxi more adaptable to the diverse needs of the residents. The research involves a systematic literature review, field studies, and a questionnaire survey to gather insights into the views and needs of residents regarding their activity modes and space. The preliminary research findings suggest that people from different ages, genders, and cultural backgrounds have unique perceptions and requirements. By providing comfort and promoting positive interaction between residents and the space, high-rise buildings can be more humanised in design. The study intends to offer insights into the possibilities for humanising the interior space of high-rise apartments and provide a theoretical foundation for sustainable design.

Keywords: Activity patterns, Humane design, Indoor spaces of high-rise residential buildings, Northern Guangxi, Perceptions and needs.

1. Introduction

There are two primary schools of thought when studying the humanisation of high-rise apartments: regionalism and modernism. Throughout the global history of high-rise residential development, regional architecture has been used to humanise these buildings. This research employs a systematic literature review to carefully select and evaluate relevant studies, extract data, and integrate it using appropriate statistical methods to obtain a more comprehensive understanding of the humanisation of regional and high-rise residential buildings. The literature review revealed differences and similarities in themes between regionalism, modernism, and critical regionalism, as shown in Fig. 1. The diagram illustrates two opposing perspectives on the humanisation of high-rise apartments. One side features thematic content expressing different viewpoints on regionalism, while the other presents thematic content expressing varying opinions on modernism. The themes of critical regionalism, which the researcher has objectively collected and summarised from regionalism and modernism, are located in the central part of the diagram.

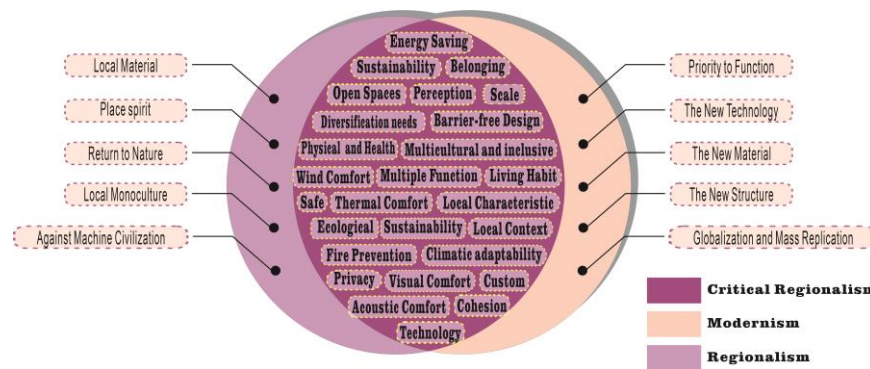


Fig. 1. Relationship of literature review themes.

1.1. Problem statements

As shown in Fig. 2, the insensitivity of the indoor spaces of high-rise apartments to end-users will lead to environmental, social, and economic problems. Environmental issues include ecological and environmental problems [1], the heat island effect [1], indoor air pollution [2], noise pollution [3], and urban landscape destruction [4]. The economic issue includes high economic pressure [5] and high medical costs. Social issues include mental diseases [6], physical health problems [7], neighbourhood conflict [8], harm to children's healthy [9], and lack of a sense of belonging [10]. The relationship between the three is that environmental and social problems influence each other, and economics will lead to environmental and social issues.

The inhumane design of high-rise residential indoor spaces that lacks consideration for end-users' well-being poses a severe risk to their physical and mental health. People living in these impersonal and standardised high-rise buildings often long for the humanistic atmosphere and unique regional characteristics of regional architecture. Therefore, implementing humane design principles from regional architecture can significantly impact the design of modern high-rise residential buildings.

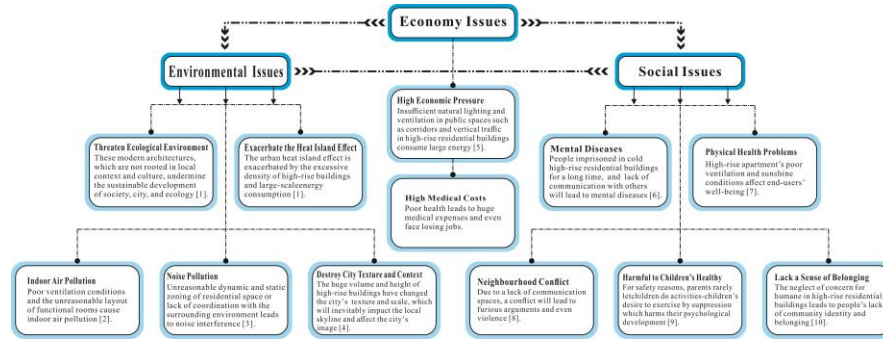


Fig. 2. Problem statements.

1.2. Research questions and objectives

The true artwork is not architecture itself but the space it creates, as space serves as the medium for various activities. Therefore, it is crucial to investigate the humane design strategies of high-rise residential spaces by examining the patterns of people's activities and their perception of space. Such research can yield valuable insights into creating living environments that promote well-being and community identity.

The analytical framework depicted in Fig. 3 illustrates the relationship between the research questions and objectives. Objective 1 pertains to studying activity patterns, while Objective 2 focuses on people's perceptions and needs. Objective 3, on the other hand, concerns the development of humane design strategies. By accomplishing objectives 1 and 2, researchers can attain objective 3, which, in turn, addresses the main research question. The framework highlights the interdependence of these objectives in achieving the ultimate goal of improving the design of high-rise residential spaces.

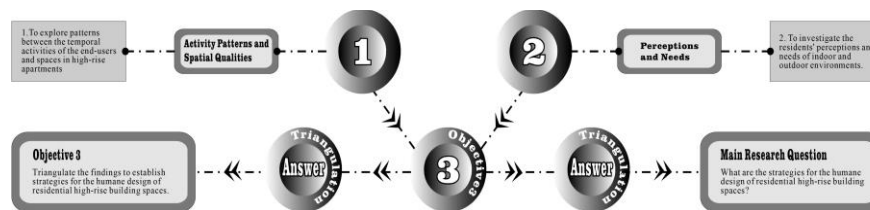


Fig. 3. Analytical framework.

Objective 1 can be established based on sub-research question 1: "What are the patterns between the temporal activities of the end-users and spaces in high-rise apartments?" Meanwhile, sub-research question 2, "What are residents' perceptions and needs of indoor and outdoor environments?" can be used to establish objective 2. Lastly, the main research question, "What are the strategies for the humane design of residential high-rise building spaces?" can be addressed through objective 3. By formulating and pursuing these objectives, researchers can better understand how to develop humane design strategies for high-rise residential buildings.

1.3. The purpose and significance of the study

This study focuses on the humane design of indoor spaces in regional high-rise residential buildings. To achieve this goal, the research employs data surveys to analyse the perceptions and needs of end-users. The insights gained from the analysis will inform the development of strategies to create more humane high-rise residential spaces.

1.3.1. Research purpose

This study identifies themes related to the humane design of high-rise apartments in northern Guangxi, such as end-users activity patterns, spatial quality, perceptions, needs, physical and psychological comfort, and local adaptability of the building. By summarising these principles, the study aims to fill the gaps in knowledge regarding research on high-rise apartments and provide guidelines for more humane design practices.

1.3.2. Significance of the study

To design modern high-rise apartments, it is important to incorporate traditional architectural elements that reflect the regional characteristics of the area. This will enhance the buildings' charm and instil national pride and confidence. Residents' sense of cultural identity and belonging can be strengthened by designing the spaces to fit in with the local folk culture and living habits. Considering residents' diverse needs and perceptions is crucial to achieving a humanised design that promotes stable community development.

The humanistic design of high-rise buildings should be based on the specific activities, perceptions, needs, and spatial qualities of end-users while also reflecting the architectural characteristics of the region. By considering the diverse needs of end-users, principles and methods for humanised design have been established for high-rise residential spaces in northern Guangxi. This can improve high-rise buildings' environmental quality and urban spatial form, promote neighbourhood interaction, and reflect humanistic care through an appropriate scale, ultimately making residents feel respected and instilling a strong sense of community. Overall, this can contribute to achieving social stability.

1.4. Limitations of the study

Although regional residential buildings and modern high-rise residential buildings differ significantly in density, height, and scale, humanistic strategies can still be applied. However, it is important to note that this study has limitations due to the enormous building height and spatial scale of modern high-rise residential buildings. Nonetheless, all types of spaces can be designed according to the human scale, which can help narrow the gap in scale.

2. Literature Review

This study provides a comprehensive overview of the research progress in humanistic regional architecture and high-rise buildings. It highlights the increasing attention given to regional buildings' livability and the growing focus on people-oriented research in high-rise buildings. This study's rigorous selection criteria and quality evaluation standards ensure that the analysed academic achievements are high quality and reliable.

There is a significant research gap in humane design for high-rise residential buildings, particularly in the context of critical regional architecture. The current policies and guidelines in China also do not provide adequate guidance for the humane design of high-rise buildings. To achieve a humanistic return of high-rise apartments, it is necessary to incorporate new technologies and adopt equitable references to local buildings.

2.1. Reasons for the lack of humanisation in high-rise residential buildings

The fast-paced lifestyle and the pursuit of material wealth have made it challenging for people to appreciate their surroundings and increased the need for humanistic care. On the other hand, architects tend to follow the trends and showcase their abilities, making it challenging to prioritise humane design. Moreover, modern technology, with its efficient mechanical assembly production, has enabled the construction of high-rise apartments quickly, giving it an advantage in the market. Finally, in today's era of consumerism and materialism, people's aesthetic preferences tend to prioritise superficial trends over deeper social issues related to human nature.

2.2. Attributes of keywords

The theoretical framework of this research is aligned with the research objectives and is composed of six major themes: space, outdoor activities, perception and needs, safety and comfort, physiological comfort, and local adaptability. Objective 1 focused on collecting data on outdoor activities and space, while Objective 2 focused on aspects related to comfort physiology, safety and comfort, perceptions and needs, and local adaptability. A toolkit containing keywords' objectives and attributes has been developed to guide the data collection process. The attributes of keywords have been classified based on the research objectives, and Table 1 shows which aspects are covered by the data collection process.

Table 1. Attributes of keywords

Objectives	Attributes of Keywords						
1. To explore patterns between the temporal activities of the end-users and spaces in high-rise apartments	Activity	Time	Space	Environment	Communication	Living Program	Behave During Evacuation
	Multiple Function	Living Habit	Scale	Behavior	Lifestyle	Activity Patterns	Physical Activity
	Social Interaction	Recreational-Activity	Children's Activity	Outdoor Activity	Smoking Habit	Disability Activities	Influencing Factor
2. To Investigate the residents' perceptions and needs of indoor and outdoor environments.	Visual Comfort	Thermal Comfort	Harmony	Sustainability	Wind Comfort	Acoustic Comfort	Scale Comfort
	Privacy	Close to Nature	Physical Health	Mental Health	Space Comfort	Emotional Comfort	Experiential Comfort
	Falling Injuries and Death	Environmental Comfort	Sense of Security	Safety of Children	Barrier-free	livability	Fire safety

Satisfaction	Esteem	Diversification needs	Life adaptation	Perception of Different Users	Multi-function	Sense of Security
Economic	Social Demand	Adapt to Social Development		Sensory Feelings	Aesthetic	Cultural Adaptation
Belonging	Cohesion	Regional Cultural Adaptation		Different preferences	Ecological adaptation	Climatic Adaptability
3. Triangulate the findings to establish strategies for the humane design of residential high-rise building spaces.			All the above keywords			

3. Research Methodology

This study mainly adopts a mixed research method that combines qualitative and quantitative methods, as follows:

3.1. Data collection methods

- **Observation Method:** An observation method is an important tool for researchers to obtain data on the behaviour and emotions of end-users in high-rise apartments. By taking photographs of the spaces and activities, researchers can gain insights into patterns and relationships that may not be apparent through other research methods (as shown in Fig. 4). This method is planned, purposeful, systematic, and repeatable, which helps ensure the data's reliability and validity.



Fig. 4. End-users' temporal activities and spaces.

- **Questionnaire Survey:** The quantitative questionnaire survey is a useful method to collect data on the perception and needs of end-users. Researchers

can design a set of questions or prepare a form for the survey based on the research objectives. This method can target and accurately measure residents' social activities in high-rise apartments. The survey can be conducted with a large sample size, and the data can be statistically analysed to describe and analyse the quantity and obtain the necessary investigation data. This method can provide valuable insights into the social aspect of architecture and help researchers understand the perception and needs of end-users.

3.2. Data analysis Methods

- The field investigation and questionnaire data will be analysed using descriptive analysis.

3.3. Case Study

As shown in Table 2, the crisis of humanisation is more severe in high-rise residential buildings with higher intensity and density. Therefore, this study selected three high-rise residential buildings with a plot ratio exceeding three as case studies and three single high-rise residential buildings for data collection. Data were collected based on factors such as the presence of shops at the bottom of the building facing the river, connectivity of the residential area to main roads, and proximity to core landscape nodes and facilities.

Table 2. Attributes of Keywords

Development Areas	Cases	Number of Floors	Total Number of Buildings	Plot Ratio	Plot Ratio Standard	Features
(40kms away from Lingchuan District and 20km away from QiXing District)	City No. 1	33	1 7	4.5	1.5-2.0 for 11-story high-rise buildings	River & Stores
Lingchuan County (30km away from Qixing District)	Tangdi zhihua	17	3 3	4.6	1.8-2.5 for 18-story high-rise buildings	Core Landscapes & Facilities
Qixing District	Fengyu	48	1 4	7.1	2.4-4.5 for houses with 19 stories or more	Convenient External Contact

3.3. Toolkits

Figure 5 illustrates the relationship between objectives and problems. The objectives were derived from environmental, social, and economic issues to solve the identified problems. Objective 1 is focused on activity patterns related to social and environmental issues and will use observation as the data collection method and correlation analysis as the data analysis method. Objective 2 is about

perceptions and needs, also related to social issues, and will use the questionnaire as the data collection method and correlation analysis as the data analysis method. By exploring end-users' activity patterns and investigating their perceptions and needs, strategies for improving spatial qualities can be established.

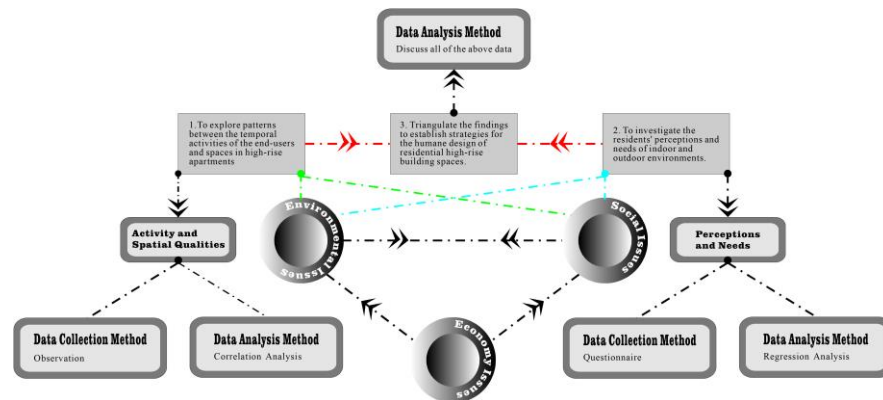
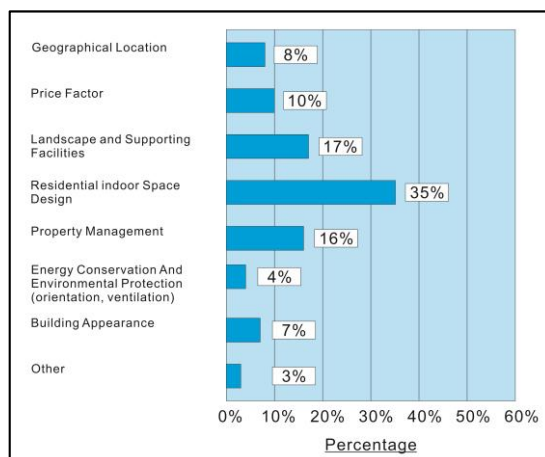


Fig. 5. Conceptual framework.

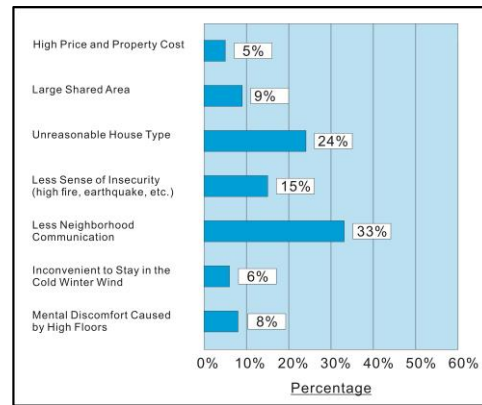
4. Data Analysis

A total of 210 questionnaires were distributed in this survey, with each community receiving 70. Out of the 210, 200 were considered valid. The age demographics of the participants were as follows: 16% were under the age of 20 (32 individuals), 32% were between the ages of 20-39 (64 individuals), 29% were between the ages of 40-59 (58 individuals), and 23% were over the age of 60 (46 individuals). The study investigated the factors that residents consider when purchasing high-rise housing. Figures 6(a) and 6(b) present the residents' opinions on the factors influencing their purchase intentions and the disadvantages of high-rise residential buildings.



(a) Purchase intention factors.

Fig. 6. Purchase intention.

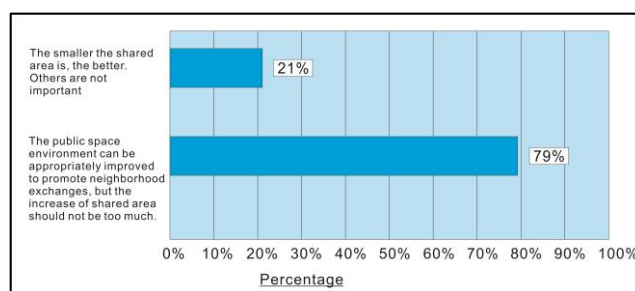


(b) Disadvantage of high-rise.

Fig. 6. Purchase intention.

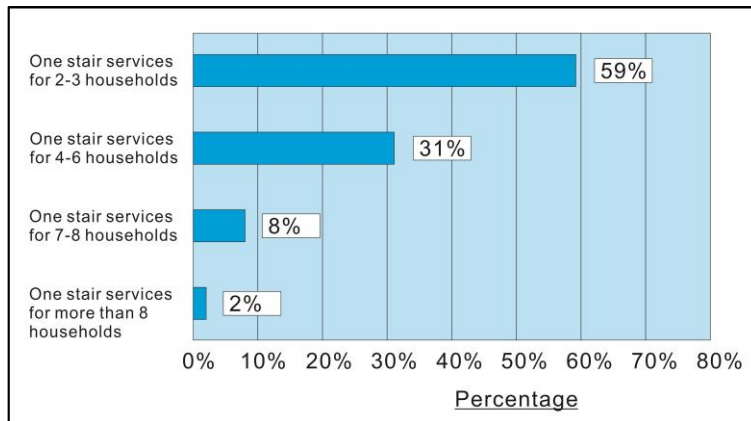
In Fig. 6(a), it can be observed that the majority of high-rise residents focus on indoor space design (35%), landscape and supporting facilities (17%), and property management (16%) when purchasing a house. Only a small percentage (4%) of residents show concern for energy conservation in buildings, unaware of its close relation to indoor thermal comfort, while the issue of the landscape can be addressed through indoor space design. Figure 6(b) highlights that 33% of the respondents see lack of neighbourhood communication as the primary disadvantage of high-rise residential buildings, followed by 24% who find house type design unreasonable, and 15% who feel insecure, worrying about fire escape and the safety of children playing on the ground unsupervised.

As shown in Fig. 6(c), 79% of the survey respondents believe that the public space environment can be improved to promote neighbourhood exchanges, but they do not want the shared area to be increased too much. In terms of floor plan design, 59% of respondents feel that one stair service for 2-3 households is the ideal arrangement. 31% of respondents can accept 4-6 families arranged around one staircase, but it is generally difficult to accept more than 6 households in the same situation. This is mainly due to poor lighting quality, inconvenient usage, and evacuation insecurity (as shown in Fig. 6(d)). The survey respondents generally believed that the advantages of high-rise residential buildings are good landscape perspective (53%), spiritual superiority (24%), and the convenience of elevators (14%) (as shown in Fig. 6(e)).

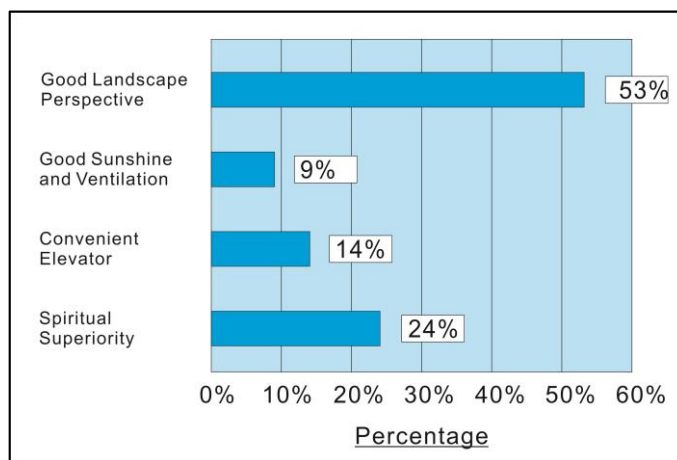


(c) Choice for shared area and comfort

Fig. 6. Purchase intention.



(d) Acceptable household numbers.

Fig. 6. Purchase intention.

(e) Advantage of high-rise.

Fig. 6. Purchase intention.

Figure 7 reveals that 46% and 41% of respondents expressed dissatisfaction with the thermal comfort of south-facing and north-facing rooms, respectively. The lack of sunshade measures for south-facing rooms causes them to become hot in the summer, while north-facing rooms are cooler in the summer and colder in the winter, resulting in poor thermal comfort year-round. 52% and 50% of respondents were also dissatisfied with the natural lighting indoors during the daytime. This is attributed to elevators and corridors being typically situated in the centre with dim lights. Additionally, poor lighting is caused by an unreasonable house type design and the plan layout of one stair service for multiple households. The spatial layout of the house was also a concern for 52% of respondents, with issues such as low space utilisation, poor privacy, inconvenient use of space, unreasonable zoning, and difficult-to-transform spaces.

About 41% and 56% of respondents expressed dissatisfaction with the ventilation, dehumidification, and air circulation in their high-rise apartments,

which can be attributed to the hot and humid summer conditions and the unreasonable layout of indoor spaces and windows. These conditions can cause increased humidity levels, leading to slippery floors and dampened furniture and clothing. Moreover, 50% of respondents were unhappy with the acoustic comfort of their apartments due to noise interference from sources such as wind, traffic, elevators, and neighbours. The layout of functional rooms was not conducive to minimising noise, with living rooms located next to elevators and bedrooms situated near the street. Additionally, 42% of respondents expressed discontent with the air circulation in their kitchens and bathrooms, which was caused by a lack of consideration for wind direction in the layout of these spaces.

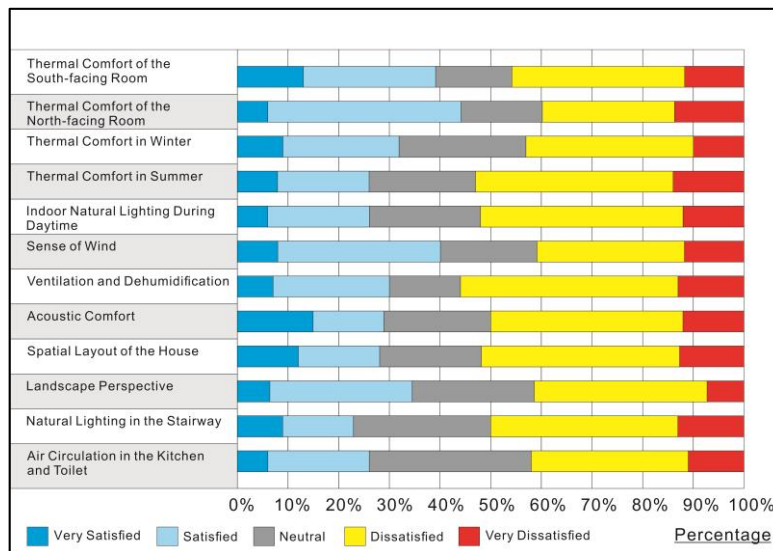


Fig. 7. Respondents' degree of satisfaction with the indoor living spaces.

Less than half (43%) of the respondents identified a lack of communication and a high-level living style as the leading causes of neighbourhood apathy, as depicted in Fig. 8. When the study investigated parents' attitudes towards their children playing in outdoor spaces, 49% of the respondents disagreed due to concerns over children's safety hazards, as shown in Fig. 9.

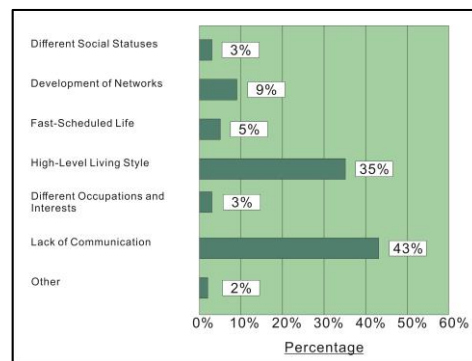


Fig. 8. The cause of neighbourhood apathy.

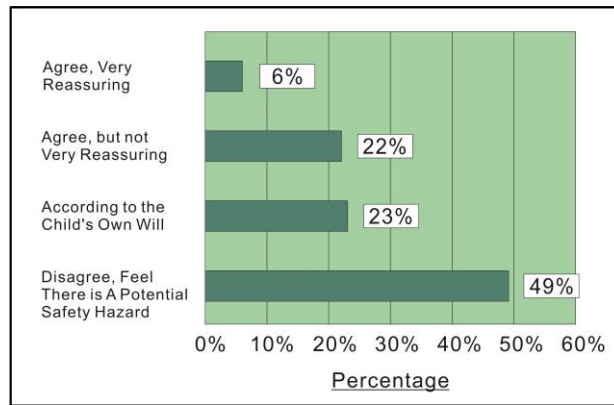


Fig. 9. Parent's attitude towards child playing in the outdoor space.

5. Results and Discussion

The study utilised descriptive analysis to evaluate the spatial quality and user satisfaction of high-rise residential areas in northern Guangxi. The relationship between spatial quality and user satisfaction, which can guide the humane spatial design and quality improvement of high-rise residential areas in the current context of globalisation and the regional architectural environment. The findings suggest that spatial function, traffic quality, safety, building appearance, climate adaptability, and landscape quality positively correlate with user satisfaction. Among them, functional quality, safety, climate adaptability, and landscape quality have a relatively high impact on user satisfaction, while the impact of street traffic quality and building appearance is relatively low.

The questionnaire mainly collected and analysed data on residents' purchase intention, living status, and perception of indoor space. The humanised design strategy of high-rise residential buildings is mainly reflected in the following aspects:

5.1. Humane design of indoor living space

5.1.1. Ecological adaptability of indoor living space design

- In Northern Guangxi, which has a hot summer and cold winter climate, it is important to consider ventilation, dehumidification, and natural lighting when designing the layout of bedrooms, living rooms, balconies, kitchens, and toilets. Poor ventilation can lead to indoor air pollution, especially in humid summer conditions.
- Designers can use both summer and winter winds to provide indoor ventilation, heat dissipation, and wind protection. Windows should be tightly sealed, and sunshade measures can be implemented for south-facing rooms to minimise solar heat gain.

5.1.2. Human-oriented indoor living space design

- In the northern Guangxi region with hot summers and cold winters, it is important to consider ventilation, dehumidification, and natural lighting when

designing the layout of bedrooms, living rooms, balconies, kitchens, and toilets to prevent indoor air pollution caused by poor ventilation. Combining summer and winter winds can provide indoor ventilation, heat dissipation, and wind protection. South-facing rooms should have measures taken for sunshades and strengthened window air tightness.

- To reduce the impact of high-rise housing on residents' psychological health, privacy in the bedroom and bathroom should be strengthened to avoid leaking residents' privacy due to improper space design. Visual landscape environments should be optimised to improve visual comfort in indoor rooms. The bedroom, study, and living room have high environmental requirements to avoid being affected by external and equipment noise due to improper handling.
- To reduce the impact of high-rise housing on residents' physical health, the indoor space design should be flexible and changeable to meet the different needs of residents in the use of space. Barrier-free design should be integrated into the design of each space, such as ensuring the width of the door and the aisle meet the requirements of wheelchair access.
- The design of indoor living space should consider people's living habits and cultural background to create a sense of belonging and pride within the community.
- Humane space design can improve residents' sense of security. According to the questionnaire survey, parents worry about potential safety hazards when their children play outside without monitoring. By arranging the kitchen adjacent to the children's activity area and ensuring the kitchen window faces the activity area, parents can monitor their children's movements while cooking and have peace of mind. It is the sense of security that humane space design gives residents.

5.2. Humane design of indoor public space

5.2.1. Humane design of vertical traffic and corridor space

- The unreasonable layout of public corridors and stairs leads to their long-term use of artificial lighting, resulting in high energy consumption and maintenance frequency. During maintenance or regular use, the alternating appearance of bright and dark corridors can cause psychological burdens and fear in young children.
- The entrance hall of a building is a transitional area that separates indoor and outdoor spaces, and its humanised scale and spatial design can improve people's comfort.

5.2.2. Humanised design of indoor public activity space

- In the questionnaire survey, respondents generally believed that the main reason for the emotional indifference between high-rise residential neighbourhoods was the lack of communication and high-level living style. To solve this problem, we can design the public activity space inside the building to promote communication between neighbours. Promote the smooth progress of activities by creating a good activity environment and high-quality space rich in regional culture, thereby enhancing the emotions between neighbours. Harmonious neighbourhood relationships are conducive to strengthening the community's sense of security.

6. Conclusions

Northern Guangxi experiences hot summers and cold winters. Indoor spaces need to address heat preservation in winter and cooling in summer. Based on observations and questionnaire responses, the following humane design strategies for high-rise residential buildings are recommended, mainly for indoor living space and public space. By studying the relationship between people's perceptions, activity patterns, and spatial quality, we can summarise the humane design strategies for high-rise residential buildings. High-quality humane space design can improve people's comfort and promote the generation of various activity modes.

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