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RESEARCH PAPER

Detecting Gender Discrimination in the Layout of Residential Buildings: A Comparative Analysis

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ABSTRACT

This paper explores the significance of considering the needs and preferences of female residents in house designs to address housing demands effectively and ensure user satisfaction. Drawing on research from various disciplines, it highlights the critical role of housing in individuals' lives, encompassing social interactions, employment, education, and family dynamics. The study emphasizes the importance of user-centric design and active participation of housewives in decision-making to create homes that accommodate diverse responsibilities and lifestyles. Utilizing space syntax analysis, the research investigates the spatial organization of homes in Abbottabad, comparing architect-designed layouts with those configured by female homeowners. Findings reveal disparities in spatial arrangements, emphasizing the need for flexible and well-connected spaces, particularly in key areas such as kitchens and lounges. Recommendations are provided for future housing designs, including seamless integration of outdoor spaces, consideration of cultural factors, and establishing feedback mechanisms with users to ensure designs evolve to meet changing needs. Overall, the paper advocates for collaborative efforts between designers and users to create sustainable and user-centric homes that reflect the unique behaviors and preferences of female residents.

Keywords: Gender Discrimination, Gender Equity in Housing, House Layouts, Space Syntax Analysis, User Preferences in Housing

Introduction

Many private home designs become ineffective when housing demands are not met or fail to adequately address the needs of female residents (Ghaedrahmati & Shahsavari, 2019). Furthermore, when these demands are not adequately considered in the design of the houses, it leads to dissatisfaction among female users (Cerrato & Cifre, 2018). Housing holds significant value for individuals as it symbolizes a home for most people, closely intertwined with various aspects of life such as social interactions, employment, education, and family life. A house can be perceived as a combination of elements designed to achieve a specific purpose, notably providing comfort (Jansen, Coolen, & Goetgeluk, 2011). Family psychological and social interactions primarily occur at home, particularly when considering individual differences (Al-Tarazi, 2021). While dwellings serve as spaces for everyday activities, architectural records reveal the diverse ways in which these activities were conducted in homes across various historical periods and cultural traditions. A house encompasses more than just a location for numerous activities; it is a complex arrangement of spaces governed by specific rules regarding their layout, connectivity, organization, and the coordination of simultaneous and sequential activities (Hanson, 2003).

The design of a house reflects the social and family dynamics of its residents. Changes in furniture, layout, and use of space indicate evolving needs in daily living.

Typically, men plan homes without much input from women, despite women spending more time at home than men (Samanani & Lenhard, 2019). The spatial organization of structures often follows a specific pattern of empty volumes, which can indicate their function or purpose. Hillier and Hanson first presented this idea in 1984, defining the relationship between space and its use with topological networks. The spatial layout of towns and buildings is quantified, illustrated, and analyzed using a theory and set of techniques called space syntax (Hillier, 2007). Configuration, which refers to the relationship between two regions while considering at least one additional space, provides a scientific foundation for understanding spatial layouts, both mathematically and visually. Evidence-based design integrates scientific knowledge into the design process (Ullah U., et al., 2022). This study examined the relationship between residential architecture in Abbottabad and its functional systems. It discovered that the spatial organization of a home is significantly influenced by the interactions among its various areas. Moreover, the layout and positioning of interior spaces are vital in determining their functionality within the broader design (Bafna & Chambers, 2014). The research delved into the similarities and disparities in spatial arrangements of houses, comparing those designed by male architects and female homeowners, aiming to identify preferred house design qualities among female homeowners.

Literature Review

A house is a multifaceted architectural structure that serves dual purposes: it functions as a practical living space for a family while also holding significant personal meaning. It represents cultural customs and traditions within the realm of domestic life. Housing, often referred to as shelter, meets fundamental human needs and carries personal significance as a home, intertwined with family dynamics, social interactions, work, and education (Ullah, et al., 2022; Al-Tarazi, 2021; Md Zohri, 2010). A well-designed home should prioritize comfort and accommodate the psychological and social activities of its residents, taking into account individual differences (Jansen, Coolen, & Goetgeluk, 2011). Houses fulfill various daily living requirements such as cooking, eating, leisure, bathing, sleeping, and storage, with historical architectural records showcasing diverse practices across different times and cultures (Ullah, et al., 2023). The spatial layout of a home holds significance, as it dictates how activities are carried out, spaces are interconnected, and functions are delineated (Hanson, 2003). The home environment encompasses symbolic, cultural, and behavioral dimensions that influence human behavior and community organization. Spatial behavior and the overall quality of life in residential settings are shaped by user preferences, which are influenced by physical, social, cultural, and economic factors (Edgü & Ünlü, 2003). Housing satisfaction is essential for residents' well-being as it reflects their contentment with living conditions. Ideal living conditions vary among individuals, with subjective and objective ideals and aspiration levels influencing housing preferences and satisfaction (Jansen, Coolen, & Goetgeluk, 2011). Residents' involvement in the housing development process enhances satisfaction by aligning design with their needs and unique behaviors. Design preferences, user productivity, and comfort play key roles in housing satisfaction, reflecting residents' perceptions of their quality of life (Abidin & Basrah, 2019).

Architectural design is a social process that involves architects and the public, with user satisfaction being a crucial measure of successful design. The involvement of non-professional stakeholders, including female residents, is vital for achieving sustainable designs that cater to specific needs and preferences (Jansen, Coolen, & Goetgeluk, 2011). The role of women in household management and their influence on home design is significant, as they spend a considerable amount of time at home. Understanding housewives' daily lives and preferences is essential for creating satisfactory living environments. Female residents' participation in the design process is crucial for achieving sustainable and user-centric designs. Preferences and choices in housing design reflect

individual needs, market conditions, lifestyle, and satisfaction, emphasizing the importance of user involvement in the design process (Al-Tarazi, 2021). In conclusion, collaboration between designers and users is necessary to create homes that satisfy residents' needs and preferences. This collaboration should focus on understanding the unique behaviors and lifestyles of female residents to achieve sustainable and user-centric designs.

Material and Methods

This Study delves into modern dwelling designs within Abbottabad's planned cantonment area, with a focus on properties ranging from 10 to 13 Marla. These designs cater to highly educated families comprising five members, particularly those from the Hazara culture. The research scrutinizes the architectural features of current homes and presents innovative ideas for residences built post-2010, taking into account the employment status of female family members. The study conducted an analysis of four existing residences and proposes four planned designs. This analysis involved a combination of qualitative and quantitative data analysis, including questionnaire responses. It places significant emphasis on crucial areas such as the drawing room, kitchen, dining area, living spaces, car porch, and laundry room. To address the dearth of research in this field in Pakistan, this research utilized Agraph and DepthmapX for floor design analysis. These tools aid in comprehensively examining modern dwelling designs, especially in the specified region.

Spatial information for Abbottabad's housing plan was acquired through interviews with housewives, aiming to ascertain their preferred house designs. This process led to the gathering of recommended floor layouts. Subsequently, the floor plans underwent digitization and analysis utilizing tools such as A-graph and Depthmap-X. Conclusions were drawn following a comparative analysis of the obtained results, with a focus on delineating disparities between the desired floor designs identified by housewives and the spatial organization observed in existing houses. The study elucidates the functional space system and its variance based on the perspectives of housewives, thus illustrating distinctions in dwelling spatial configuration across different genotypes. The study employed Space Syntax, a simulation program, to conduct a Syntactic analysis of connectivity and spatial configuration on both existing houses and dwellings proposed by housewives in Abbottabad.

Results and Discussion

This analysis offered insights into women's architectural preferences. The connectivity index was represented visually through a color-coded floor plan generated by the space syntax modeling program Depthmap x, with blue indicating low value and red indicating highest value. An evaluation was conducted on the ground level and first-floor architectural layouts, taking into account the average depth, integration, and control values of the dwellings. The most significant finding in this comparative study was the observed difference in the analyzed spectra.

Comparison of house plans (House- A &A1): Women's expectations and the current house layout in House A differ from the proposed design in House A1, as indicated by the Depthmap-X and j-graph studies. Significant enhancements are evident in House A1, particularly in the increased emphasis on the kitchen and the prioritization of the lounge over the porch. Changes in the average depth underscore the importance of user-centered design in optimizing spatial layouts and reveal potential discrepancies in accessibility. The proposed design showcases a more cohesive and interconnected spatial arrangement that better caters to the requirements of the female residents. Overall, these differences present House A1 with an opportunity to elevate the living standards of its female occupants by prioritizing their needs.

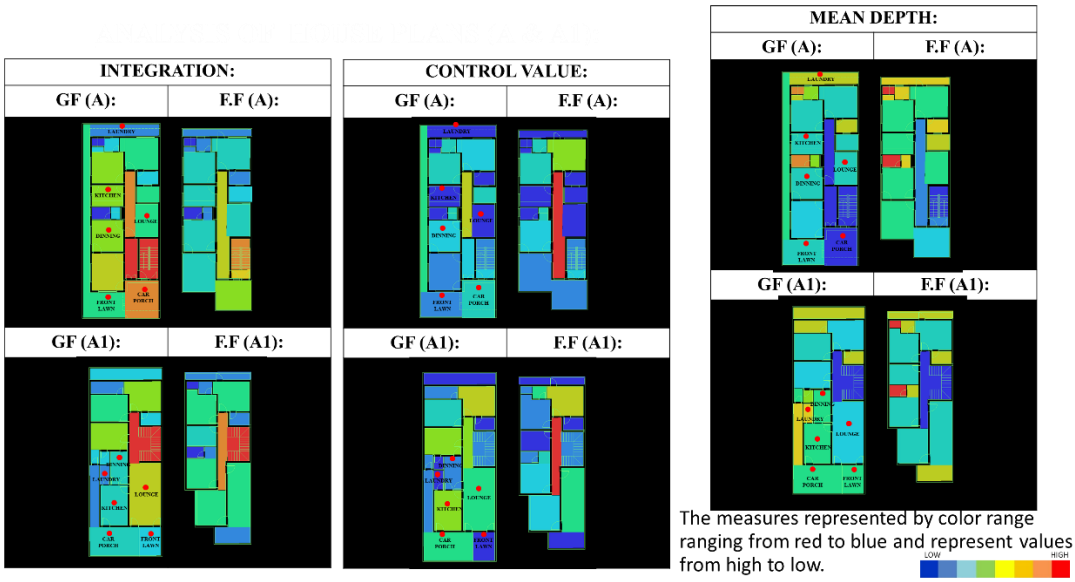

Figure 1 Integration (HH), control value (CV) and mean depth (MD) of house plans (A and A1)

Table 1

Spatial order for the factors Mean depth (MD), integration (HH), Control value (CV) for houses (A) and (A1) respectively.

CASES	INTEGRATION (DECENDING ORDER)					
Existing (A)	**Car porch**	dinning room	**kitchen**	front lawn=	**lounge**	**laundry**
Proposed (A1)	lounge	dinning=	kitchen	car porch	front lawn	laundry
CASES	CONTROL VALUE (CV) (DECENDING ORDER)					
Existing (A)	**carporch**	dinning room	**front lawn**	kitchen=	**lounge**	**laundry**
Proposed (A1)	kitchen	lounge	car porch	dinning	front lawn	laundry
CASES	MEAN DEPTH (ASCENDING ORDER)					
Existing (A)	**car porch**	**dinning**	front lawn	**kitchen=**	lounge	**laundry**
Proposed (A1)	lounge	kitchen=	dinning	car porch	front lawn	laundry

Comparison of house plans (House- B &B1): Depthmap-X and j-graph analyses of houses B and B1 reveal discrepancies in meeting women's needs, highlighting areas for spatial design improvement. House B focuses on the garage, kitchen, and lounge, neglecting integration in the dining room and front lawn. In contrast, House B1 prioritizes an interconnected layout, emphasizing the lounge while also valuing the kitchen and dining areas. These changes aim to align spatial arrangements with contemporary design principles, enhancing user engagement and flexibility, especially for female residents. The proposed design aims to create a harmonious living environment that prioritizes women's satisfaction and well-being, ultimately enhancing the quality of life for all house members.

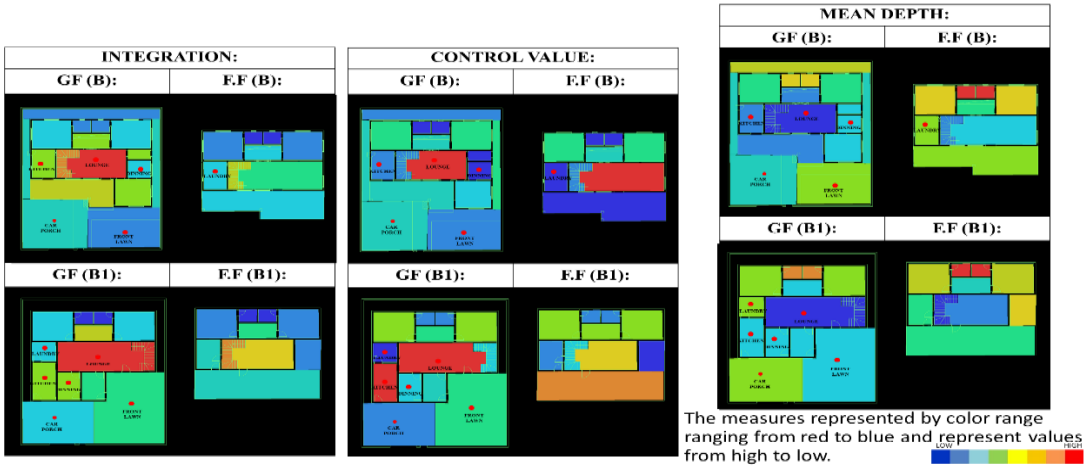

Figure 2 Integration (HH), control value (CV) and mean depth (MD) of house plans (B and B1)

Table 2

Spatial oder for the factors Mean depth (MD), integration (HH), Control value (CV) for houses (B) and (B1) respectively.

CASES	INTEGRATION (DECENDING ORDER)					
Existing (A)	**lounge**	kitchen	**Car porch**	dinning room	**laundry**	front lawn
Proposed (A1)	lounge	kitchen	dinning room	front lawn	car porch	laundry
CASES	CONTROL VALUE (CV) (DECENDING ORDER)					
Existing (A)	**lounge**	**carporch**	kitchen	**front lawn**	**dinning**	laundry
Proposed (A1)	lounge	kitchen	front lawn	dinning room	car porch	laundry
CASES	MEAN DEPTH (ASCENDING ORDER)					
Existing (A)	**lounge**	kitchen	**car porch**	dinning room	**laundry**	front lawn
Proposed (A1)	lounge	kitchen	dinning room	front lawn	car porch	laundry

Comparison of house plans (House- C &C1): Significant differences in spatial connectivity were identified in the evaluations of homes C and C1, underscoring the need to better align with women's expectations in the home. The proposed House C1 shows subtle variations in the spatial layout of the carport, hinting at potential changes in user engagement, while areas like the laundry maintain a sense of privacy. The front lawn is prioritized in the proposed design, emphasizing deliberate efforts to enhance its functionality and interaction. These findings underscore the importance of adopting a user-centered approach and conducting ongoing observations to ensure that spatial configurations can easily adapt to evolving needs and preferences. Ultimately, the proposed layout presents an opportunity to enhance living conditions and prioritize the satisfaction and well-being of the female residents of House C1.

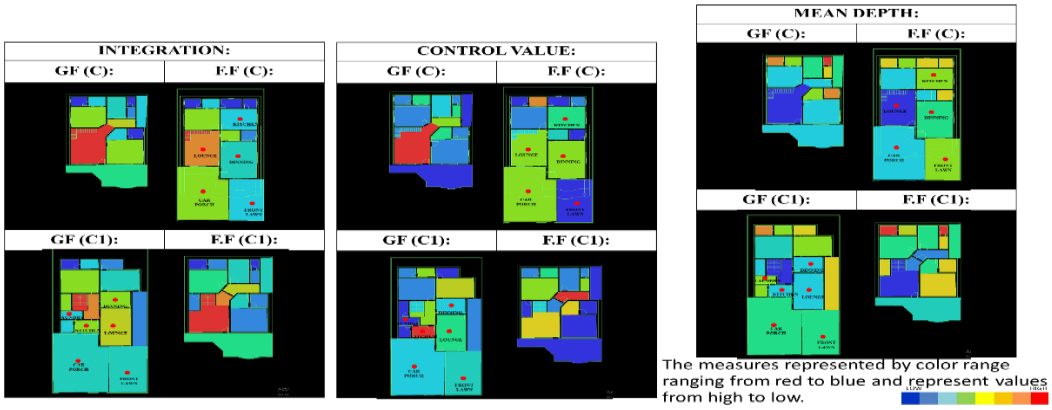

Figure 3 Integration (HH), control value (CV) and mean depth (MD) of house plans (C and C1)

Table 3

Spatial order for the factors Mean depth (MD), integration (HH), Control value (CV) for houses (C) and (C1) respectively.

CASES	INTEGRATION (DECENDING ORDER)					
Existing (C)	**lounge**	carporch	**dinning**	front lawn=	**kitchen**	laundry
Proposed (C1)	lounge	kitchen=	dinning	front lawn=	carporch	laundry
CASES	CONTROL VALUE (CV) (DECENDING ORDER)					
Existing (C)	**dinning=**	**lounge**	car porch	**kitchen**	**front lawn**	laundry
Proposed (C1)	kitchen	lounge	front lawn	dinning=	carporch	laundry
CASES	MEAN DEPTH (ASCENDING ORDER)					
Existing (C)	**laundry**	lounge	**car porch**	dinning	**kitchen**	front lawn
Proposed (C1)	lounge	kitchen=	dinning	car porch	front lawn	laundry

Comparison of house plans (House- D &D1)

Significant differences in spatial connectivity are evident between dwellings D and D1, emphasizing the importance of meeting women's expectations effectively. In House D,

the kitchen is the focal point, with the dining and living areas playing supporting roles, while the front lawn is seldom utilized. Conversely, House D1 strategically adjusts the layout to enhance spatial functionality while still emphasizing the kitchen's significance, particularly in the front yard and garage areas. These design adaptations reflect a deliberate effort to prioritize user satisfaction and well-being in House D1, suggesting the potential for a more luxurious living environment tailored to meet the needs of female residents.

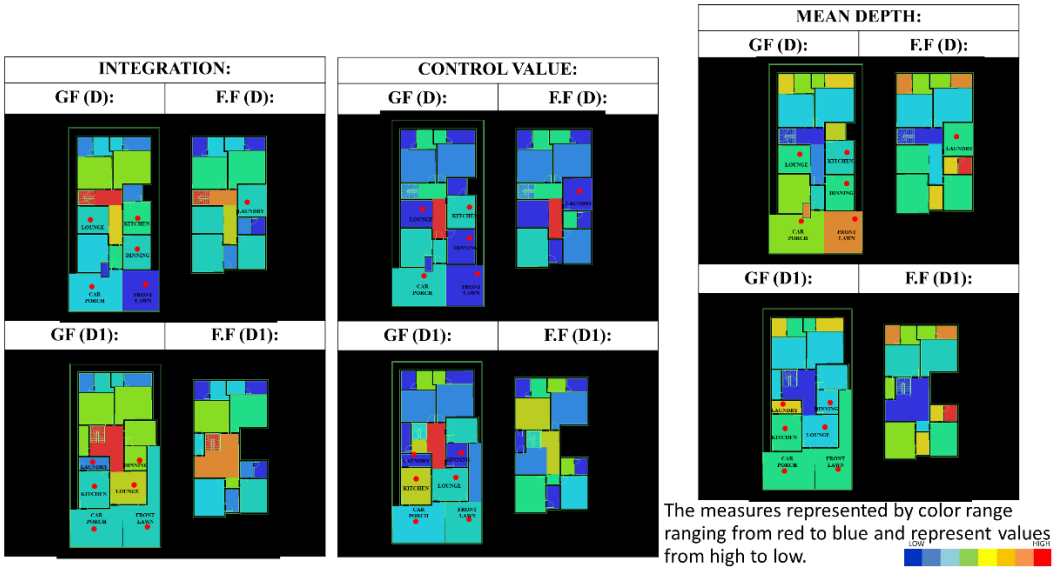

Figure 4 Integration (HH), control value (CV) and mean depth (MD) of house plans (D and D1)

Table 4
Spatial order for the factors Mean depth (MD), integration (HH), Control value (CV) for houses (D) and (D1) respectively.

CASES	INTEGRATION (DECENDING ORDER)					
Existing (D)	**kitchen**	Lounge=	**dinning**	laundry	**Front lawn**	Car porch
Proposed (D1)	**kitchen**	lounge	**Front lawn=**	carporch	**dinning**	laundry
CASES	CONTROL VALUE (CV) (DECENDING ORDER)					
Existing (D)	**Front lawn**	**kitchen**	Car porch	**laundry**	**Lounge=**	dinning
Proposed (D1)	**dinning**	kitchen	Car porch	Front lawn	lounge	laundry
CASES	MEAN DEPTH (ASCENDING ORDER)					
Existing (D)	**kitchen**	Dinning=	**lounge**	laundry	**Front lawn**	Car porch
Proposed (D1)	kitchen	lounge	Front lawn=	Car porch	Dinning	laundry

Conclusion

The analysis of architect and user-created layouts in Abbottabad using space syntax and user engagement yields key insights across Cases A, B, C, and D. In Case A, the dining room and kitchen hold prominent positions, with the car porch as a focal point, while the front lawn, lounge, and laundry appear less central. The lounge emerges as the most interconnected space, suggesting potential for significant transformation. Similarly, in Case B, the car porch stands out as significant and well-integrated, along with the dining area and kitchen, whereas the front yard, lounge, and laundry seem less central. Notably, the lounge gains prominence in the proposed scenario, indicating a shift in spatial dynamics. Case C identifies the dining room, garage, and lounge as key spaces, with deliberate modifications enhancing functionality, especially in the lounge. The significance of the front yard is highlighted, alongside adjustments to the car porch. In Case D, the central role of the kitchen is emphasized, with planned modifications focusing on enhancing the functionality of the front lawn and rethinking the car porch integration. Across all cases, personalized designs elevate lounges, prioritizing comfort and relaxation, particularly in kitchen layouts. Adaptable outdoor spaces, like the front lawn, reflect the user-centric approach, resonating

with homemakers' daily tasks. These findings underscore the potential to reconfigure spaces to better accommodate diverse user needs and consider gender impact on spatial arrangements. Redesigning spatial layouts aligns with modern design principles and user preferences, enhancing functionality and aesthetics while fostering healthier living environments, guided by spatial hierarchy and insights from homemakers.

Recommendations

Based on this study the following major points are recommended for the planning and design of future houses.

- Active participation of housewives in decision-making and user-centric design is crucial to ensure that spatial configuration meet their needs and preferences.
- Designing flexible rooms that accommodate the diverse responsibilities of women in the household is essential.
- Special attention should be given to key areas such as kitchens and lounges, which play a central role in daily life and family interactions, ensuring they are well-connected and centrally located.
- Dining spaces and laundry rooms should be designed with usability and family prefernces in mind.
- Seamless integration of the car porch and front lawn with the house is important.
- Consideration of geographical and cultural factors is also essential.
- Establishing a feedback mechanism with users ensures that designs evolve to meet changing needs and preferences, resulting in a home that truly reflects its residents.

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