

A Preliminary Study on the Usage Behavior Pattern and Needs of the Ground Floor Entrance and Exit Section of a Detached House: Take Lǐ-Siǎng Community in Tainan as an Example to Discuss

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Abstract—“Arcade (Ding-a-ka)” has been discussed in the context of Taiwan’s indigenization and modernization. In the past research. The research results include: Historical aspect’s study of planning codes and spatial form for Arcades. And other street preservation issues etc. Our research found that on the one hand, “Arcade” and “Dwelling” are related. On the other hand, it is a public space that extends from environmental-behavior. This research paper discusses the environment-behavior of dwellers in urban growth boundary. The scope of this article is to use the method of architectural facade space’s case analysis and semi-structured interviews for residents. The purpose of the study is to discover the housing with different attributes on the architectural fa-cade space’s arcade, whether it will be influenced by the usage behavior and needs or it will arise the privatization of the public sphere elements. Discuss the community repair activities by the users of the architectural fa-cade space. The anticipated research contributions are understanding the disappearance of dwellers in history through “Arcade” and “Ding-a-ka” review. And how to get fieldwork information of public sphere through grounded theory (open coding) and environment-behavior. Access to a different kind of public domain in Taiwan community discussion than in the west theory.

Keywords—usage behavior pattern and needs, environment-behavior, ground floor entrance and exit section of a detached house, public space (public domain), Lǐ-Siǎng Community in Tainan City

I. INTRODUCTION

Compared to northern Taiwan, the urban areas of central and southern Taiwan are characterized by a gradual emergence of both separate and close living patterns due to the shared responsibility of family care and child rearing, resulting in a high proportion of choices with a detached house. While there has been a steady growth in the number of detached houses, there has also been a change in the morphological characteristics. For example, in addition to the basic function of interaction and communication with the neighbors at the entrance and exit of the first floor, there are new issues that have not been discussed.

The traditional discussion of “Arcade (Ding-a-ka)” has stalled at the stage of abstracting the values of the times and the commercial functions. On the other hand, the ground floor entrance and exit section of a detached house, which is designed for living, has a spatial position equivalent to that of

a “Arcade”. But with more significance and ambiguity, which is neglected due to daily life habits. For example, the architectural symbols of the ground floor entrance and exit section of modern community convey unique architectural meanings. From the outwardly visible to the inwardly visible, it leads to a close relationship between time and the experience of use. The extension explains that while the ground floor entrance and exit section has become a symbol of new capital, the various characteristics of the occupant’s use have disappeared.

Here, we understand the importance of the ground floor entrance and exit section of a detached house in southern Taiwan, but we cannot clearly discuss the difference in positioning from the “Arcade” and the new symbolic meaning in the residence-oriented questioning. It is through the environment-behavior research that we can understand the problems with the use of the ground floor entrance and exit section of a detached house.

II. LITERATURE REVIEW

A. Residential Façade And “Arcade (Ding-a-ka)”

“Façade” generally refers to the front exterior wall of a building, representing the outward appearance of the structure. Domestic research related to façades tends to focus primarily on the study of façades of street houses, Western-style buildings, commercial skyscrapers, apartment complexes, and residential compounds from the Japanese colonial era. This includes architectural styles, scale proportions, colors, and materials, such as the column arrangement on the façades of Kinmen Western-style residential buildings by Nieh *et al.* [1], the segmentation and material composition types of arcade façades. However, there is little exploration regarding typical detached houses.

The discussion with the keyword “Arcade (Ding-a-ka)” reveals that research in Taiwan typically focuses on the historical development context and the evolution of architectural forms. There are two main research directions in general: firstly, in the field of architecture, investigating the correlation between the spatial scale of arcades (Arcade) and regional culture. For example, the name “Arcade” is associated with commercial economic activities that give rise

to features like covered walkways, street stalls, and arcades [2]. Second, we conduct comparative case studies to discuss the intermediary spatial characteristics of “Arcade” and clarify its localization or indigenization, extending to urban disaster prevention perspectives [3]. The two aforementioned substantial research directions focus on the architectural structure and regulatory requirements of “Arcade” itself, but cannot connect with the “arcade” of the ground floor entrance and exit section in modern housing. This suggests that commercial arcades cannot homogeneously explain the residential characteristics.

In summary, the “Arcade (Ding-a-ka)” in mixed-use neighborhoods lacks discussion concerning the privacy and ambiguity of residential areas. The architectural form of the ‘arcade’ in the ground floor entrance and exit section of a detached house does not adhere to the regulations set during the Japanese colonial period. While these two overlaps spatially, they have entirely different interpretations in reality.

B. Boundary and Territory

The “boundary” is a noun specifically used to delineate borders and limits, often employed in the context of national borders, county lines, community divisions, residential boundaries, and the like. On the other hand, “territory”, in the field of ethology, refers to a specific area occupied by an individual within a particular species, used to resist the intrusion of conspecific or heterospecific individuals. In the study of ‘residential territories’, previous research in indigenous traditional territory surveys has focused on discussions related to land management. The text describes changes in the territories of specific groups, land rights relationships, and subsequent investigation and assessment recommendations.

In contrast to this, the field of design psychology proposes a more in-depth discussion focused on ‘identity’ and the ‘residential effect’, beyond memory, ideals, comfort, and happiness. The field of study posits that the individual characteristics of residents and their living conditions, encompassing both material and psychological aspects, serve to accentuate the territoriality inherent in biological individuals or groups within specific spatial configurations, such as single-entrance detached residences or gated communities. On the other hand, it ensures safety within the domain of daily life and the establishment of defensive spaces externally. However, a stance extending from individual residences to communities has not been observed. In light of this, the present study conducts an in-depth investigation into the adjacent and internal facets of ground floor entrance and exit section of a detached house in single-entrance residential units and their external facades.

C. Openness/Closure and Security

The concept of ‘security’ is a fundamental requirement for residential environments. In the fields of architecture and civil engineering, it is intricately linked to factors such as residential satisfaction, community layout, spatial openness, and smart living. The research findings underscore the significance of external environmental threats and evolving societal dynamics as pivotal contributors to the perceptual variations in residential environments. Furthermore, research primarily centered on the elderly demographic is constrained

to strategies for mitigating risk factors following age-related functional decline and post-space adaptation (remodeling).

Based on this research review, it is evident that the establishment of “security” in living environments necessitates a close integration of the residential and community spaces at both the psychological (internal) and environmental (external) levels, achieved through the active participation of residents or community members. This study focuses on the delineation forms and materials of ground floor entrance facades, elucidating the characteristics and issues related to safety that they manifest.

III. MATERIALS AND METHODS

A. Framework Design of the Study

In this study, we set road width and park landscape features as critical influencing variables and employed purposive sampling to survey locations in three types of communities: those adjacent to commercial main roads, those adjacent to purely residential secondary streets, and those facing park green spaces.

The study is structured around three research dimensions:

- 1) Compiling facade partition forms and materials of the ground floor entrance and exit section of a detached house;
- 2) Discussing boundary forms of neighboring residential dwellers on both sides of a detached house;
- 3) Gaining insight into boundary forms and considerations along the roadside of a detached house. The research framework is illustrated in Fig. 1.

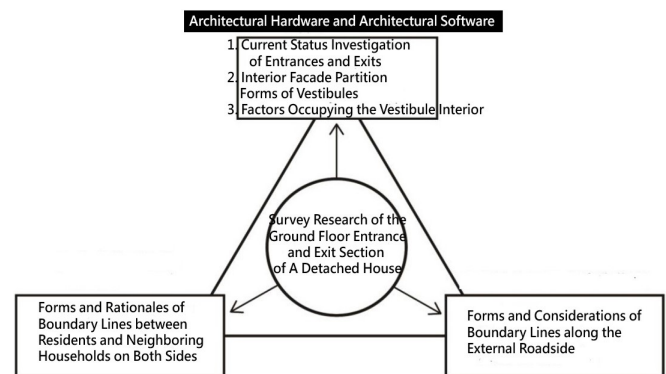


Fig. 1. Research design framework diagram.

B. Framework Design of the Study

The ‘Li-Siǎng Community’, comprising Da-An Village and Li-Siang Village, is located in An-Nan District, Tainan City, Taiwan, previously known as An-Shun District (Fig. 2). It is demarcated by the Chi-Shui River and borders the An-Ping District, West Central District, and North District. Prior to the 1970s, the area consisted of fish ponds and agricultural land adjacent to the Jian-Nan Canal drainage branch. Subsequently, it underwent urban expansion and became a planning base for a large new township. The research site encompasses Da-An Village (1,538 households, population 4,220) and Li-Siang Village (1,784 households, population 5,212) (Table 1) [4]. These communities were developed and constructed by the Li-Siǎng Construction Company and have a history of over 40 years. The majority of residents within the community (either homeowners or renters) have migrated from outside the city and belong to the working-class social strata.

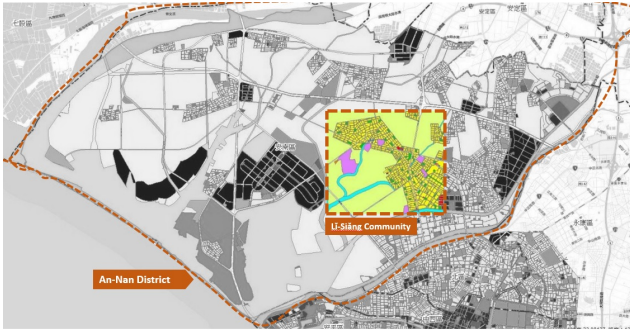


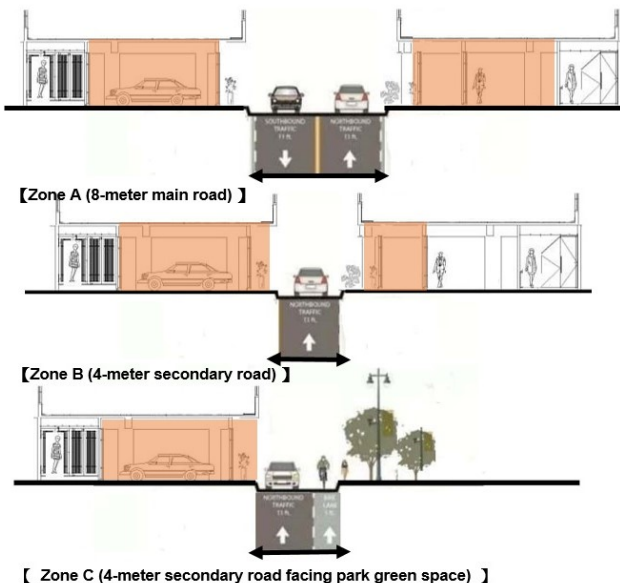
Fig. 2. Area of research (geographical environment of An-Nan District, Tainan City).

Table 1. Research area and sample distribution zone

Item	Zone A			Zone B		Zone C		
	Part A	Part B	Part C	Part A	Part B	Part A	Part A	Part C
Sample Location	No. 88 to 160 Da'an St.	No. 61 to 65 Da'an St.	No. 69 to 71 Da'an St.	No. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23 Lane 124, Da'an St.	No. 10, 12, 14, 16, 18, 20, 22, 24 Lane 124, Da'an St.	No. 1, 3, 5, 7, 9, 11, Lane 177, Da'an St.	No. 2, 4, 6, 8, 10, 12, 14, 16 Lane 145, Da'an St.	No. 14, 16, 18, 20, 22, 24 Aly. 88, Lane 150, Sec. 2, Hai-dian Rd.
Sample Number	Sample A-01 to A-15	Sample A-16 to A-18	Sample A-19 to A-20	Sample B-01 to B-12	Sample B-13 to B-20	Sample C-01 to C-06	Sample C-07 to C-14	Sample C-15 to C-20
The Total Number of Samples	15 Samples	3 Samples	2 Samples	12 Samples	8 Samples	6 Samples	8 Samples	6 Samples



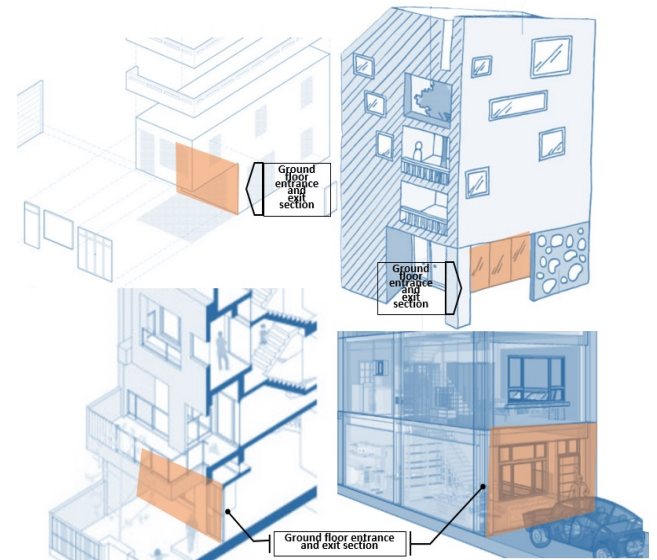
Fig. 3. Research survey scope and A, B, C area sample.



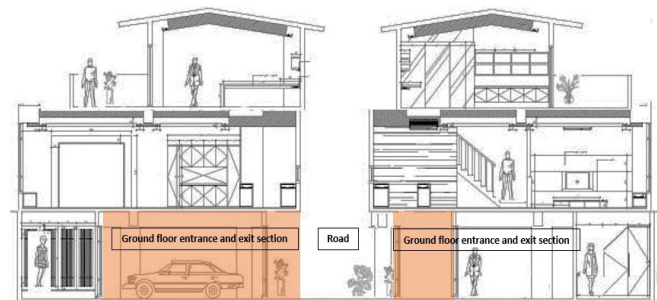
Note: The orange block is ground floor entrance and exit section of a detached house

Fig. 4. Road width and ground floor entrance and exit section of a detached house (Schematic diagram).

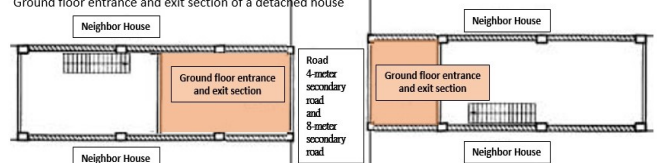
This study focuses on the important variables of road width and park green space. Therefore, a purposive sampling method was applied to select 'pure residential' households in three different zones: Zone A (8-meter main road), Zone B (4-meter secondary road), and Zone C (4-meter secondary road facing park green space) as the sample for analysis in this study (Figs. 3–5) [5]. There were 20 cases selected from each of these three zones, resulting in a total of 60 cases. The field survey was conducted from November 1, 2022, to July 15, 2023.



【Perspective diagram】
Ground floor entrance and exit section of a detached house



【Elevation Schematic】
Ground floor entrance and exit section of a detached house



【Floor Plan Schematic】
Ground floor entrance and exit section of a detached house

Fig. 5. Ground floor entrance and exit section of a detached house (Perspective diagram, elevation schematic and floor plan schematic).

IV. RESEARCH RESULT AND DISCUSSION

A. Material and Segmentation of Façade in the Ground Floor Entrance and Exit Section

Based on the research findings regarding the material of residential entrance facades, it was observed that in all three study areas, A, B, and C, the surveyed samples predominantly exhibited physical external barriers such as roller doors, grille gates, and security iron doors, which served to enclose the exterior environment. The combined proportion of such cases amounted to 85%. This objective observation suggests that the observed phenomenon is less associated with factors such as road frontage width and the nature of the subject property (residential or green space) and more closely related to the security context and the residential territories (Fig. 6).

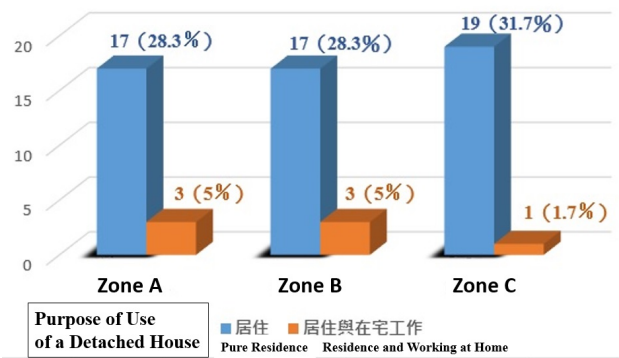


Fig. 6. Purpose of use of a detached house.

On the other hand, the findings of the investigation focusing on “segmentation of façade at the residential entrance” reveal the following: In Area A, the majority of segmentation exhibits a single and bifurcated pattern. In Area B, bifurcation is the primary form, with some instances of more than bifurcation. In Area C, the findings are similar to those of Area C, with the distinction lying in the diversity of materials and segmentation forms. Based on objective observations, it is evident that these patterns are correlated with location attributes, specifically the commercial ratio of the external environment, as well as the necessity for garage functionality. The research results demonstrate that the materials and facade segmentation of residential entrances are unrelated to aesthetic considerations and regional culture.

B. Boundary Forms of Neighboring Residential Dwellers on Both Sides in the Ground Floor Entrance and Exit Section

Regarding the assessment theme of “boundary evaluation with adjacent neighbors”, two aspects were defined for discussion: “using materials to demarcate sightlines” and “maintaining the original appearance (visual transparency)”. The research findings indicate that among the samples in the three study areas, a total of 88.3% falls into the “having boundaries” category, while “without boundaries” accounts for only about 10%, reflecting a significant disparity in their proportions. In Area A, all cases (33.3%) are compelled to enclose the boundaries with neighboring residences on both sides due to their location along an 8-meter main road and the dual residential and small-scale commercial activities within neighboring households. The key influences in this context are regional context and security considerations.

In contrast, the research results for Area B (28.3%) and Area C (26.7%) seem to exhibit relatively higher proportions. Of note is the feedback item related to “close neighborly emotions and interactions”, which explains the retention of low walls and partitioning materials provided by developers, without additional materials being incorporated, as evidenced by the survey results.

In terms of materials (as shown in Table 2), primary materials utilized include iron roll-up doors, simple partition walls, and solid brick walls, while the selection of materials for adjacent partitioning on both sides is associated with the “neighborly interaction (visual and auditory)” feedback aspect. In Zone C, due to the presence of garden villas as a residential form, the boundary lines between adjacent households not only exhibit high visual transparency but also indicate frequent interaction. Even within the research sample, it is observed that despite the use of shading materials to create visual boundaries, considerable attention is given to the choice of materials, as it is considered an expression of daily life taste.

Conversely, in Zones A and B, the emphasis on materials with strong shading characteristics is not as prominent. Lastly, based on the aforementioned observations and statistical results, it is found that, in the context of boundary formation in the three zones examined, most of the research samples tend to prioritize “basic needs” and “high ubiquity” as decisive considerations when making their material selections.

Table 2. Statistics table of materials that block neighbor’s line of sight

Item	Materials that Block Neighbor’s Line of Sight		
	Material	Total number of samples	Proportion
Zone A	Iron rolling door	6	10%
	Iron rolling door and plywood	5	8.3%
	Multiple types of plywood (board, sheet metal)	2	3.4%
	solid wall (brick or other materials)	7	11.7%
Zone B	Multiple types of plywood (board, sheet metal)	8	13.3%
	Solid wall and multiple types of plywood on grille (Original Developer Planning)	2	3.3%
	on grille (Original Developer Planning)	3	5%
Zone C	Solid wall (brick or other materials)	7	11.7%
	on grille (Original Developer Planning)	6	10%
	Solid wall (brick or other materials)	10	16.8%
	Solid wall and multiple types of plywood	4	6.7%

C. Boundary and Forms of Roadside along at the Residential Entrance

The survey results indicate that in Zone A, out of 20 samples, 18 samples employed iron roll-up door materials as the boundary and forms of roadside along the residential entrance. In Zone B, among the 20 samples, 19 samples utilized overhead iron roll-up doors, supplemented with additional security iron gates on the sides. In Zone C, among the 20 samples, 18 samples featured overhead iron roll-up

doors in combination with composite doors, wrought-iron grilles, and security garage doors, resulting in a more diverse range of interface forms. The reason behind this diversity lies in the mixed nature of the research samples in this zone, which encompass both typical detached houses and garden villa-type residences. For instance, samples C15 to C20 represent the latter category, featuring not only the widest facade width among the three zones (ranging from 11.2 to 13 meters) but also complete garden planning within the front yard space. This planning, including greenery and flower arrangements, delineates the “residential territories” and ensures the security of shielding from external views, indirectly affecting the proportion of internal facade openings (doors and windows).

Table 3. Facade segmentation form classification table (ground floor entrance and exit section)

Item	Facade Segmentation Form	
	Form	Elevation view (surveying and mapping)
Zone A	<ul style="list-style-type: none"> ■No partitioning Facade width: 4.8/5.0m 	
	<ul style="list-style-type: none"> ■Split into two Facade width: 5.8m 	
	<ul style="list-style-type: none"> ■Six partitions Facade width: 5.0m 	
	<ul style="list-style-type: none"> ■Four partitions Facade width: 4.8/5.0/5.8m 	
	<ul style="list-style-type: none"> ■Two partitions Facade width: 5.0m 	
	<ul style="list-style-type: none"> ■Four partitions Facade width: 5.0/5.8m 	
Zone B	<ul style="list-style-type: none"> ■One partitions Facade width: 4.7/7.2m 	
	<ul style="list-style-type: none"> Facade width: 8.24m 	
	<ul style="list-style-type: none"> ■Two partitions Facade width: 4.7/6.2m 	

<ul style="list-style-type: none"> Facade width: 5.2/7.2m 	
<ul style="list-style-type: none"> ■Four partitions Facade width: 5.0/5.2m 	
<ul style="list-style-type: none"> Facade width: 6.2m 	
<ul style="list-style-type: none"> Facade width: 6.2/7.2m 	
<ul style="list-style-type: none"> ■One partitions Facade width: 5.4/6.2m 	
<ul style="list-style-type: none"> Facade width: 8.24m 	
<ul style="list-style-type: none"> ■Two partitions Facade width: 5.4m 	
<ul style="list-style-type: none"> Facade width: 9.8/11.2/12.4/13m 	
<ul style="list-style-type: none"> ■Four partitions Facade width: 4.8/6.2m 	
<ul style="list-style-type: none"> Facade width: 8.24m 	
<ul style="list-style-type: none"> Facade width: 6.2/7.2m 	

From the overall analysis of the research results, it is observed that 97% of the housing units adopt a flexible, commonly available, and easy-to-implement approach for their interface and form with the adjacent road, with an emphasis on accommodating anti-theft and parking needs. In the case of Zone B samples, narrower facade widths (ranging from 4.7 to 6.2 meters) led to the adoption of outward-protruding iron roll-up doors to extend the residential space towards the road. Examples of this include (Sample B2, Sample B5, Sample B8, Sample B10, Sample

B12, Sample B13, Sample B14, Sample B16). Regarding the categorization of “Internal Facade Opening Division Method/Material” as depicted in Table 3, it is evident that single doors, two-panel divisions, and four-panel divisions account for over 85% of the usage. Aluminum horizontal sliding or outward-pulling mesh window doors are commonly selected, with facades featuring two-panel or four-panel divisions for external sliding windows.

In Zone A, an 8.3% proportion of samples exhibit no internal facade, a scenario is absent in Zones B and C. This variation is speculated to be related to the mixed residential and commercial nature of the area, where the importance of security along the roadside boundary outweighs the need for internal facade definition, as the space extending outward from the entrance area is seen as equivalent to its disappearance.

From the above observations, it is evident that community residents tend to maintain the entrance and facade elements as planned by the construction company. Subsequent changes are primarily motivated by a shift towards simplified and mass-market material choices during maintenance. There are exceptions among the samples, such as Sample A6, Sample A8, Sample A9, Sample A14, and Sample A17. These cases, due to their conversion of space into garage use and past leasing to beverage shops or home-based work, did not include internal facades between indoor spaces (living rooms) and entrance areas, extending directly to the external road interface. Therefore, it can be inferred that in the residential entrance space, shaped jointly by internal facades and external contact surfaces, residents approach the replacement of facade openings with materials from a utilitarian perspective. Another scenario is when residents consider the material choices made by other community residents as crucial references during renovations. Overall, practicality and functionality take precedence over design and aesthetics as the main criteria for such decisions.

V. DISCUSSION AND CONCLUSION

A. Facade Partition Forms and Materials

In the context of the ground floor entrance and exit section of a detached house study within this article, based on a purposive sample of 60 cases, we have discerned that the Ideal Community in Tainan City exhibits a high residential tenure attachment with relatively low residential mobility. However, due to the expansion of modern residential behavior patterns and factors such as an increase in family members, the original living space experiences insufficiency or alterations in usage patterns. This gradual transformation leads to the closure of the ground floor entrance space, originally delimited by both internal and external facades, with flexible materials (such as overhead iron roll-up doors) sealing off the external interface (adjacent road). Most samples typically adhere to the habit of “closing during the day and opening at night (applicable to research samples where all family members work during the daytime)”, which is closely related to the security of the residential domain.

The final results indicate that, for research samples drawn from three different locations within the same community, Zone A, situated along a major thoroughfare, exhibits higher levels of external enclosure and adjacent household boundaries on both sides compared to Zones B and C. Based

on current observations and data inferences, this may be attributed to the heightened openness of the external environment (business districts and unfamiliar neighborly relationships) posing a threat to residential security and prompting proactive measures to establish territorial delineation.

On the other hand, concerning the discussion of entrance façade segmentation, Zone A primarily employs large-scale segmentation (either single or split into two). The condition in Zone B is characterized by a symmetrical form (mirroring), which is generally consistent with the initial planning patterns of the construction company. In Zone C, due to the need for sightlines, the façade segmentation takes on a more diverse form.

B. Boundary Forms of Neighboring Residential Dwellers on Both Sides

In the ‘Boundary Forms of Neighboring Residential Dwellers on Both Sides’ category, Zone A exhibits a higher level of enclosure. This can be attributed to the frequent mixed-use nature of residential and commercial activities along the main thoroughfare, leading to changes in the spatial configuration of doorways and emphasizing territorial and security considerations. The material use strategy in this area is characterized by greater durability compared to the other two areas, featuring solid materials such as full-faced bricks and roll-up doors.

In contrast, Zone B predominantly adheres to the original low-height wall design established by the developer, with the quality of neighborly interactions on both sides of the property being a key consideration for determining whether to increase the height of these boundaries.

Zone C displays a coexistence of openness and enclosure, stemming from the extensive greenery in the entrance spaces, which serves as a form of delineation for the residential domain.

C. Boundary and Forms of Roadside along

The architectural façade is regarded as a manifestation of symbolic concepts, serving not only to convey the visions of designers and residents but also to project an image of seclusion from external environmental influences. The survey data presented above validate the sampling of three research zones within the Lǐ-Siǎng community of Tainan City. In general, these samples are oriented towards pure residential functionality and adopt a closed-off approach to the external environment. With the exception of a few unique samples influenced by factors such as building size, form, and the aspiration to convey a high-quality residential image, the prevalent trend involves a coexistence of the ground floor entrance and exit section with additional elements, including sunshades and the use of solid brick walls to delineate the internal and roadside facades.

In conclusion, our investigation reveals that the definitions of the ground floor entrance and exit section in the three study zones differ from the traditional concept and usage patterns of “Arcade (Ding-a-ka)” space. This distinction remains evident even when the physical locations of these spaces overlap. The variable of ‘road width’ is found to be associated with the extent to which the external environment poses threats to residential security and territorial integrity.

Furthermore, in the discussion of the ‘boundary forms of

neighboring residential dwellers on both sides', we observe a positive correlation between neighborly relationships and privacy. Finally, our examination validates that in the planning of urban periphery new towns (communities) constructed in the 1970s–1980s, considerations regarding the materials used in building facades lean towards universality, ease of procurement, and simplicity of maintenance. This situation underscores the presence of more unplanned and experiential issues, in contrast to the past emphasis solely on the architectural aesthetics of traditional arcade spaces.

The spatial representation of the ground floor entrance and exit section of a detached house reflects the community's culture and the residents' lifestyle. It is closely related to issues such as the definition of residential domains, privacy, and security. The parameters of the situation facing the road, including road width and building facade width, impact the facade form and usage of the ground floor entrance and exit section.

Drawing on insights from cognate disciplines, we develop a theory of community boundary, territory, and security impacts that articulates their potential importance. By tracing the recurring relational patterns, the paper identifies three instances when boundary and forms of along can be considered as stabilized during boundary, territory, and security. The various styles of the neighbors in the ground floor entrance and exit section of zones developed from these three modes. These manifestations of symbolic concepts provide a nuanced perspective into the multiplicity of stylistic practices. Limiting and shaping contact between the neighbors in the ground floor entrance and exit section of zones, exacerbates territorial conflict and ultimately affects the psychological wellbeing and life course outcomes of those living at the frontier. The focus on the ground floor entrance and exit section, which emphasizes the recurrence of these relations, helps in identifying and extending the daily activities of resident experience and emerging types of entrance. Despite its potential, the contribution of this study

remains limited. We present our thesis as a series of propositions and corollaries, and reflect on the implications for empirical research of other urban life patterns in Taiwan.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Shu-li Huang and Szu-yu Tzeng conducted the research; Shu-li Huang analyzed the data; Shu-li Huang and Szu-yu Tzeng wrote the paper; all authors had approved the final version.

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