

RESEARCH ARTICLE

Intermediate space for housing design learned from tradition of Korean *maru* and Turkish *sofa*

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Received 7 January 2022; received in revised form 7 November 2022; accepted 14 December 2022



KEYWORDS

Traditional Korean house;
Traditional Turkish house;
Maru;
Sofa;
Intermediate space

Abstract The study examines traditional design approaches for intermediate spaces of residential buildings to support environmentally driven design strategies of current practices. For the evaluation of the potential of traditional design strategies, traditional houses of Korea and Turkey are explored by making a detailed comparison of *maru* and *sofa* according to theoretical considerations on intermediate spaces. After examining the concept of the intermediate space and the general characteristics of Korean and Turkish traditional housing, 10 cases from 17th to 19th centuries are selected and compared to clarify the features of *maru* and *sofa* as intermediate spaces. Based on the results, the arrangement of *maru* shows characteristics of contradiction between interior rooms and intermediate spaces in a monotonous structural repetition, while *sofa* presents an apparently hierarchical spatial composition. *Sofa* has the placeness quality, while *maru* has the quality of plurality, actively mixing both inside and outside environments. While *maru* allows various free access with clear spatial continuity, *sofa* produces a sequential spatial experience with the pleasure of different architectural qualities. Finally, the study suggests opened type and closed type of intermediate space as two possible strategies for modern houses based on the results of comparative analyses. Recent environmental studies in architecture should consider intermediate spaces of various traditional houses due to the insights and possibilities these spatial elements may potentially provide to both architectural practice and theory, especially in a pandemic era.

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Peer review under responsibility of Southeast University.

1. Introduction

1.1. Study background and objectives

Considering the increasing demand for eco-friendly architectural design, the importance of “intermediate spaces” continue to grow. These transitional spaces between interior and outdoor spaces are characterized by blurred boundaries and ambiguous spatial characteristics, and have long been discussed under various names, such as “boundary space”, “middle space”, “border space”, or “in between space”, in different architectural discourses. However, this study is based on the fact that traditional residence buildings of every culture have long accommodated traditional lifestyles while mediating artificial and natural environments in a balanced way, i.e., by not only protecting users from outside threats, but also absorbing its benefits. By looking at the architectural wisdom of tradition, the study aims at identifying the potentialities of traditional intermediate spaces and inspiring new ones meeting the current needs for eco-friendly modern housing.

Compared to Western architecture, where these spatial elements include open corridors, verandas, loggias, porches, and balconies, intermediate spaces are more actively used in Asian buildings, often being their central places where people gathered and enjoyed their family life. In many Asian traditional houses with a timber structure, intermediate spaces tended to be central and multi-functional open rooms between or in front of the houses’ main rooms, where everyday family life routines as well as circulation needs took place.

This study examines Korean “*maru*” and Turkish “*sofa*”, two representative types of intermediate space of Asian traditional housing. Although the distance between Korea and Turkey is far, we identify interesting similarities between both types of intermediate spaces in terms of function and spatial configuration. Korea and Turkey are both located between 35- and 42-degrees northern latitude, showing mixed characteristics of marine and continental climate. Considering the layout of their traditional buildings, both have closed courtyards limited by stone or building walls that have a central role in buildings. This study examines the strategies used in the design of *maru* and *sofa* to achieve both their spatial and functional characteristics.

The fact that the idea of *maru* and *sofa* is still applied in the design of modern Korean and Turkish houses for sun shading and ventilation purposes proves the importance of these intermediate spaces to improve their spatial comfort. Instead of adopting technological solutions to design environmentally driven housing envelopes, we believe that the strategies used in the design of intermediate spaces such as the Korean *maru* and Turkish *sofa* can inspire architectural solutions for modern houses’ intermediate spaces and improve its habitability.

1.2. Research methods and scope

The study consists of an analysis of the architectural characteristics of Korean and Turkish traditional houses, a comparison of their intermediate spaces, namely *maru* and *sofa*, and discussion of architectural strategies that are

relevant for contemporary housing design. Specifically, the research method and scope are as follows.

Firstly, after studying the concept of intermediate space, literature, images, and websites information on traditional housing of Korea and Turkey were analysed, particularly those on the *maru* and *sofa*.¹ The collected information is summarized in the theoretical parts of the paper.

Secondly, after general comparative studies on traditional intermediate spaces using 3D models, 10 sample cases were selected: five houses from Korea and Turkey built between the 17th and 19th centuries.² The selected cases were typical traditional houses with well-sized *maru* or *sofa* in which the spatial qualities of the intermediate space could be properly explored.³ Based on drawings and pictures, plan drawings of parts of case houses were generated for comparison purposes.

Thirdly, a research framework for the comparative analysis of *maru* and *sofa* was suggested. Three main categories were established, along with three diagrammatic expressions to help the comparative analysis of different intermediate spaces according to the categories set.

Fourthly, the spatial characteristics of *maru* and *sofa* were compared using the theoretical framework. Three diagrams for each house were produced to analyse their spatial characteristics and qualities as mediators between interior and exterior spaces. The results of the analysis are organized by similarities, differences, and architectural principles in Tables.

Finally, the research findings were summarized and discussed. The spatial characteristics of *maru* and *sofa* were reinterpreted from a modern architectural perspective so that architects can apply certain features of traditional intermediate spaces to their practice.

2. Traditional intermediate spaces

2.1. Meaning and characteristics

The idea of “border” or “boundary” has long existed in human civilization allowing people to create places in the

¹ This study intended to conduct field research such as direct visits to cases in Korea and Turkey, actual surveys, observational surveys, and interview surveys. However, in the end, we had to limit the study to literature research using existing data due to the virus pandemic situation.

² The study found that representative traditional dwellings can be seen in both countries during the period between the 17th and 19th centuries. *Hanok*, the representative culture of Korea residences, were first built in the 14th century in the Joseon Dynasty and continue to modern times after experiencing their golden days from 17 to 19c. Meanwhile, the Turkish house has been built since the 15th and 16th centuries, influenced by Ottoman culture. The Turkish house showed its greatest spread in the 17th and 18th centuries. In these periods, Istanbul houses became an ideal type that is always imitated in the Near East and Eastern Europe. This progress and expansion did not cease even in the 19th century.

³ This study does not argue that the selected cases may represent all the traditional houses of both countries. Rather, the main concern of the selection was whether their intermediate spaces would be suitable for comparative analysis.

Table 1 Major recent research about the spatial characteristics of “Intermediate space”.

Researcher (Year)	Title of Research	Classification of Intermediated Spatiality
Son (2006)	Study on the plan of commercial & cultural facilities that apply the concept of intermediation space	Continuity, hierarchy, accessibility, plurality, boundedness, contradiction, node
Doh (2009)	A study about spatial experience on intermedia space of eco-architecture	Symbolism, hierarchy, boundedness, directionality, continuity, superposition, contrast, openness, territoriality
Min and Lee (2009)	A study on the public space with re-definition of infrastructure based on the concept of the intermediate space	Link, disconnect, buffer
Park and Yoon (2018)	A study on the renovation of university building – focused on the space of intermediate	Connectivity, location, functionality
Kim (2020)	The planning characteristics of private external space –focusing on the balconies, loggias and terraces as intermediate spaces	Extensibility, buffer, identity

chaotic universe by simply establishing the limits separating one area from another.⁴ In this sense, intermediate space can also play the role of border but in a more complex way: these spaces are more than simple boundaries separating inside and outside spaces, often merging the characteristics of two overlapped areas (Kim, 2020).

There are many architectural terms for intermediate space, such as threshold, in-between space, border space, liminal space, soft edge, mediation space, and buffer zone. In particular, the term of “threshold” proposed by Alison and Peter Smithson (1970) and that of “in-between space” by van Eyck (1976) are well known and have long been discussed.⁵ These concepts all agree that intermediated spaces can be ambiguous, neither completely belonging to the indoors or outdoors of a building nor to any third situation. Based on the papers in Table 1, intermediated spaces can be classified according to their spatial characteristics.

2.2. The case of traditional Korean housing

Hanok, the traditional Korean housing originated in the 14th century during the Joseon Dynasty, is representative of Korean culture. Hanok houses are mainly made of wood, soil, stone, straw, tiles, and paper (Fig. 1) and can be divided into tile roof houses for the upper class and straw roof houses for the middle class. Regarding their plans, they have a similar configuration of three main spaces: the *ondol*⁶ for winter,

the *maru* for summer, and a kitchen (Nani and Robert, 2018). Facilities such as toilets, barns and warehouses were built separately.

The layout of houses during the late Joseon Dynasty varies slightly depending on the area and on the family social status and living style (Jeon, 2016). Among them, only those in the middle and southern areas had various sorts of *maru* for climate reasons (Fig. 2).

The Korean *maru* is a room with a hardwood floor without a heating system, so it is hardly used during the wintertime. It is not just a place for everyday family life, but also an honourable place where ancestral tablets are kept and the ancestral rites are performed (Yoon, 2002). *Daecheong-maru*, a *maru* located at the centre of the house, is especially significant due to being used for important family events such as weddings, as well as a dining room or a reception room for guests. The *maru* is also the intermediate space between the house’s outside and inside spaces, and it can be classified according to its form, location, and floorboards structure in the following categories (Table 2).

Toen-maru and *daecheong-maru* are the two main types of *maru*. The former is an area directly connecting the house’s courtyard with its rooms, and the latter is a central area indirectly connecting the outdoors with its rooms (Yoo, 2005). Although both spaces are open-air and do not present any surrounding walls, they convey a sense of internal space since they are enclosed by pillars and covered by roofs and eaves.

Among the various types of Korean *maru*, the main focus of this study is *daecheong-maru* which accommodates various family activities, such as wedding, funeral, and ancestral rites ceremony as well as everyday housework and family gathering. Therefore, one can consider *daecheong-maru* as the only *maru* as a place in Hanok while other *marus* are either subsidiary aisles or additional spaces. Considering that Turkey’s *sofa* has more diverse internal spatial characteristics, the study limits the subject of comparative analysis to *daecheong-maru*, which is the most internal *maru*, while representing Korean *maru* as a “sacred space”, “entertainment space”, “multipurpose space”, and “buffering space” (Kim, 1990).

⁴ Edmund Riche said, “We are creating artificial boundaries here and there in the middle of the space of a natural and unnatural continuum.” Youichiro Hosaka, trans. by Jinmin Lee (1999).

⁵ von Meiss argued that neglect of the threshold by modern architecture was vehemently denounced by some post-war architects such as Alison and Peter Smithson, Aldo van Eyck and Herman Hertzberger. Pierre von Meiss, 1990. *Elements of Architecture: From form to place*, Van Nostrand Reinhold, pp.148-153. For recent discussion, see Oh, K., Ahn, W., Jeon, Y., 2008.

⁶ *Ondol* is a Korean form of underfloor heating that uses direct heat transfer from wood smoke to the underside of a thick masonry floor.

Table 2 Types and characteristics of *maru* (You, 2013).


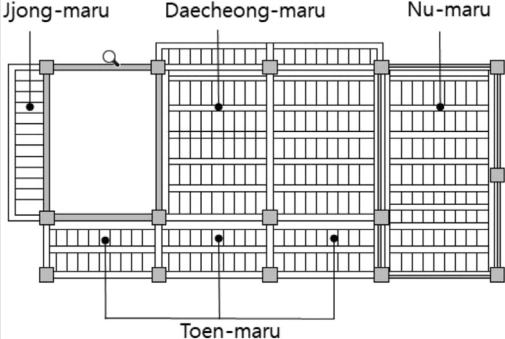



Type	Image	Characteristics	Location/ Layout
<i>Daecheong-maru</i>		The biggest <i>maru</i> located in all hanoks. The important symbolic place for the four ceremonial occasions	
<i>Toen-maru</i>		A wooden-floored <i>maru</i> in front of a room or a wooden hall, connecting rooms	
<i>Jjong-maru</i>		A long, narrow <i>maru</i> in front of a room or a wooden hall acting as stairs to enter a room	
<i>Nu-maru</i>		A pavilion-type <i>maru</i> mainly used for men's quarters in upper-class houses	

Table 3 Types and characteristics of *sofa* (Matsushita, 2004, p.13, Bozkurt, 2018, p.54).


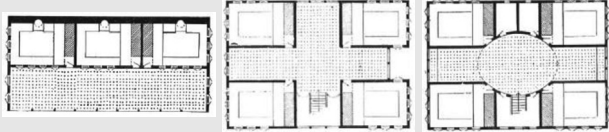
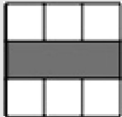
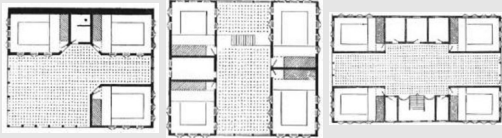
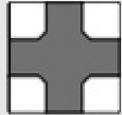
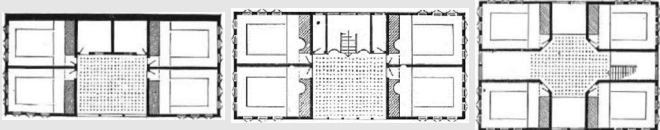
<i>sofa</i> type	Diagram	Plan example
<i>Outer sofa</i>		
<i>Inner sofa</i>		
<i>Central sofa</i>		



Fig. 1 Roofs made of straw and tiles for traditional Korean residences: (a) A typical three-bay straw roof house; (b) A tile roof house with *ondol* rooms and *maru* (Jeon, 2016).

2.3. The case of traditional Turkish housing

Traditional housing in Turkey vary from single- to three-story houses and are classified into four types with regard to their building materials. While in northern Anatolia, wood is the main building material, in eastern Anatolia, it is stone, in central Anatolia, it is wood, earth brick and stone, and in southern and south-western Anatolia, stone and wood.

The houses built in Anatolia during the Ottoman period of the 18th and 19th centuries are considered representative examples of traditional housing. Houses with wooden structures similar to those in Korea are mainly distributed in Istanbul, Anatolia, Greece, and the Balkans. Although these houses differ in terms of building materials and the wealth and size of the households, they have a common architectural vocabulary reflecting the history, culture, and lifestyle of Turkish society (Hassanpour and Soltanzadeh, 2015) (Fig. 3).

The *sofa* is always the major spatial component, its structure determining the house’s overall shape. Besides being used as a circulation space, the *sofa* also accommodates family life activities and events. The *sofa* can be classified into three major plan types: “*outer sofa*”, “*inner sofa*”, and “*central sofa*” (Eldem, 1954) (Table 3).

The *outer sofa* is the most typical type of plan in Turkish houses. It is often located in front or at the corner of a house, directly facing the surrounding nature, while linking it to the house’s inside rooms. This type of plan appeared in Anatolia and Istanbul during the 16th and 17th centuries, and was used until the 19th century.

The *inner sofa* is the second most common type of Turkish housing plan, being often in between two rooms. This type of plan is originated from the 18th century, becoming widespread in the 19th century. Many *inner sofa* are found in Istanbul.

Table 4 Cases of traditional Korean housing (Background images for plot plan from Yi, 2015).

	K-1	K-2	K-3	K-4	K-5
Name	Residence of Kim Dae-ja in Naganseong	Residence of Kim Dong-su in Jeongeup	Residence of Bukchondaek in Hahoe	Residence of the Gyodong Choi Clan in Gyeongju	Residence of Kim Champan in Yeongdong
Period	19c	18c	19c	18c	18c
Location	Naganmyeon, Suncheon-si, Jeollanam-do	Sanoemyeon, Jeongeup-si, Jeollabuk-do	Gyeongju-si, Gyeongsangbuk-do	Gyeongju-si, Gyeongsangbuk-do	Yanggangmyeon, Yeongdong-gun, Chungbuk-do
Plot plan (Red dotted area: Ancha zone)					
Ancha plan (Daecheong/Toenmaru)					

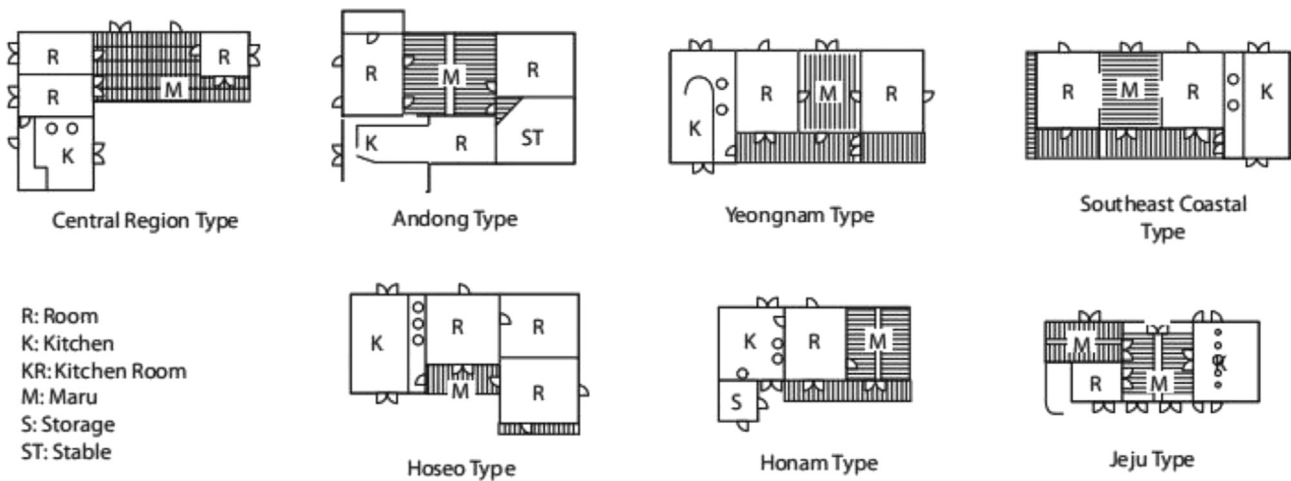


Fig. 2 Types of traditional Korean house in middle and southern areas (modified from Jeon, 2016, p.43).



Fig. 3 Example images of traditional Turkish houses: (a) Traditional Ula House; (b) House of Middle Sofa Type (Erarslan, 2018).

The *central sofa* plan type was widely used in Istanbul. Initially it had rectangular corners, but over time, the corners were formed into octagonal, polygonal, and oval shapes. Sometimes, it contained a heating installation in its centre. This type was created in the 18th century and continued to be used until the 19th century.

This study focuses on the *outer sofa* because it has many similarities with the Korean *maru*. Nevertheless, some *inner sofa* were also considered in the analysis, particularly the more open ones. Regarding *central sofa* examples, no case study was selected due to being not considered intermediate spaces and thus being outside the scope of this study.

3. Methodology

3D models of the two simplest cases studies were produced using 3D Max software to understand their general characteristics and increase the spatial perception planar analysis. Looking at their sectional characteristics, it is visible that both *maru* and *sofa* have a ceiling supported by pillars and are elevated about 1 m off the ground by the stone base. *Sofa* have banisters on its edge since there is a sudden rise from the ground, but *maru* shows a gradual rise without



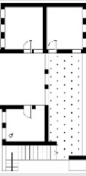
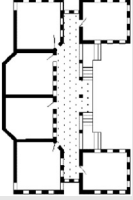
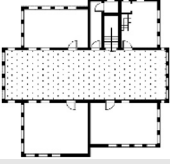
banisters. Both *maru* and *sofa* directly connect with the rooms through doors and windows, the former often having a central location, whereas the latter is often attached to a row of rooms. *Maru* itself doesn't have any level variation, but *sofa* has a separate sitting area with a higher level called *Ivan*, which can be found in the left corner of Turkish sofa image of Fig. 4.

3.1. Case selection

Based on literature review on traditional housing of Korea and Turkey, ten cases were selected for a detailed analysis of their intermediate spaces spatial characteristics. After examining the selected cases' spatial composition, their plan drawings were redrawn in AutoCAD to uniformize the collected data for comparison purposes, and to facilitate the subsequent creation of diagrams.

The study found that Korean houses in southern areas (Hoseo, Honam, and Yeongnam) built between 18th and 19th centuries have a variety of well-sized *maru* that actively mediates indoor and outdoor spaces, probably reflecting their warmer weather conditions. The traditional Korean house consists of a group of buildings that can be divided into two main zones: the husband's (*sarangchae*)

Table 5 Cases of traditional Turkish housing.

	T-1	T-2	T-3	T-4	T-5
Name	Rural outer sofa house	The Muradiye House (House of Sultan Murad II)	Talas house	Beyoğlu House	Hasköy, Harapçeşme Sok
Period	17–18c	17c	19c	18c	18–19c
Location	Anatolia	Bursa's Muradiye Neighborhood	Kayseri, Talas towns	Kula	Istanbul
Type	outer sofa (two-room)	outer sofa (with <i>iwan</i>)	outer sofa (with <i>iwan</i>)	outer sofa	inner sofa
outer/inner sofa					

and the wife's space (*anchae*). Since *daecheong-maru* is located at the center of *anchae*, the study sorted out the area of *anchae* and generated precise plan drawing of it for further analysis (Table 4).

In the case of Turkey, collecting data on traditional houses was difficult probably because most of the traditional architecture was replaced with new buildings (Eldem, 1954). Despite traditional Turkish house being often composed of three-story, the study concentrated only on the floors, containing the outer or inner sofa (Table 5).

3.2. Research framework for comparative analysis

After analyzing previous research on intermediate spaces characteristics (Table 6), the study found that these can be examined through two different perspectives, i.e., regarding their spatial arrangement and their relationship with the surroundings: the degree of physical openness of their boundary and the degree of their connectedness with indoor and outdoor spaces. Based on this, the study established three main categories for the spatial analysis of intermediate spaces: arrangement, openness, and connectedness with indoor and outdoor spaces.

The first category "arrangement" examines intermediate spaces' planar composition, having as sub-categories "form", "composition", and "hierarchy". The second category "openness" explores the conditions of all spatial boundaries, having as sub-categories (1) the physical connectivity of the intermediate space with surrounding spaces, (2) its spatial identity and quality, and (3) the plurality of features resulting from the juxtaposition of interior and outer areas. The last category, "connectedness", analyses the spatial perception and circulation flows of intermediate spaces, including as sub-categories (1) the physical connectivity with surrounding spaces, (2) the visual continuity, and (3) the direction of the existing passage flows and their relationship with surroundings.

By reflecting on the characteristics of each category and sub-category, three styles of plan diagrams were proposed. The aim was to effectively represent the spatial characteristics of each category for spatial analysis purposes (Table 7).

The diagram for the arrangement category is an abstract plan drawing, where each intermediate space and neighbouring rooms are expressed as outlines of their planar forms, the former being represented in grey and the latter in white, their sizes, shapes, and spatial relationships.

The diagram for the openness category concentrates on the intermediate spaces' boundary conditions, which are expressed with different line styles: black bold lines represent the parts blocked by walls, where breaks represent the doors and unfilled double lines the windows, while thin dotted lines show the openings towards outdoor spaces.

The diagram for the last category represents the unseen flows across the intermediate spaces' boundary, where user movement is expressed by lines connecting circles, which represent each internal space, or black triangles, which represent the access points to the intermediate space. Arrows with dotted lines represent visual connections through openings and windows in walls.

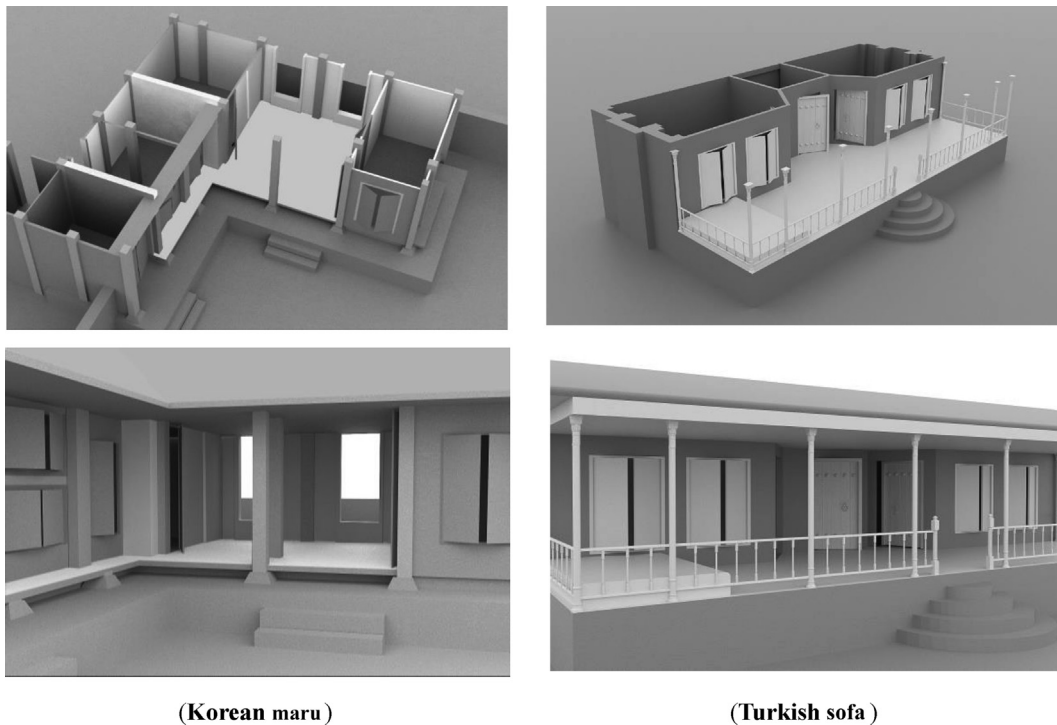


Fig. 4 3D images of Korean *maru* (Residence of Beak in Yangju) and Turkish *sofa* (Traditional Ula House).

Table 6 Meaning and properties of spatial characteristics of intermediate space.

	Meaning Summary	Examples/ Properties
Boundedness	- Spatial distribution between physical/boundary elements - Space visibility and sense of security/defense	Provide privacy and shelter
Continuity	- The order of experience according to the movement in the house - Perceptual continuity while moving	Continuous infinite space of ambiguous boundaries.
Directionality	- Spatial axis orientation and the direction of motion/circulation flows - Horizontal orientation reflecting specific behavioral systems of mental significance	Verticality, horizontality
Overlapability	- Visual perception and spatial experience caused by the superposition/overlapping of different spaces	Space layout creating sense of space
Plurality	- Spatial plurality resulting from the overlapping of internal and external space characteristics	Intermediate space, communication space

3.3. Comparative analysis

3.3.1. Arrangement of intermediate space

The first type of diagrams was used to compare the spatial arrangement of the two countries' intermediate spaces (Table 8).


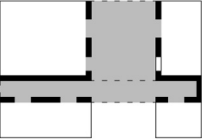
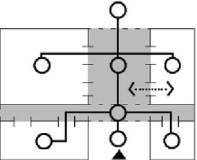
First the ratio of intermediate spaces to total floor area, varying from 12% (T-1) to 60% (T-3) in both countries, with an average of 30%–40% of the total area of housing.

Regarding their overall shape, the layout shape of *maru* and *sofa* are relatively diverse, the former presenting simple and regular forms (i.e., a combination of the rectangular *daecheong-maru* and the linear *toen-maru*), the later having a wide range of shapes. These differences

seem to be closely related to structural systems used in each case: Turkish houses use wooden wall frame systems, whereas Korean houses are made of a beam-column system using thick timber that must respond to stricter construction metrics (Matsushita, 2004).

In terms of hierarchy, Turkish houses spatial distribution looks more hierarchical due to the location, size, and shape of their *sofa* being more determinant than the remaining spaces. In contrast, Korean traditional housing plans show a blurred hierarchy because the existing *maru* depends on its entwining with surrounding spaces. However, the *daecheong-maru* still looks like the core of a house in spite of its biased location because it has a big empty space contrasting to solid units of rooms and is a functional center to

Table 7 Research frame for analysis of intermediate space.

Category/Diagram sample	Spatial Characteristics	Analysis Items
Arrangement 	Form	Plan shape - Square/ Regular/ Irregular
	Composition	- Single/ Distributed/ Integral Plan arrangement and spatial relationship
	Hierarchy	- Central/ Biased/ Corner - Number of neighbouring rooms Spatial hierarchy - Primary/ Subsidiary
Openness 	Boundedness	Boundary condition - Degree of open/closed boundary
	Placeness	- Clarity of intermediate definition Physical characteristics as a place - Quality of <i>maru/sofa</i> area as a place with identity
	Plurality	- Spatial elements expressing placeness Physical characteristics as intermediate space - Spatial plurality of mixed interior and outdoor - Spatial elements inducing interior/outdoor condition and characteristics
Connectedness 	Accessibility	Connectivity with interior/outdoor spaces - Amount of direct access
	Continuity	- Spatial depth and type of connection Visual continuity of spaces - Continuity of spatial experience
	Directionality	- Perceptual continuity between indoor/outdoor spaces Spatial orientation - Axis setting and relationship with surroundings - Passage flow and direction of movement

which many other *toen-maru* and rooms are connected (Table 9).

3.3.2. Openness towards indoor and outdoor

Table 10 compares the boundary conditions of both types of intermediate space in terms of degree of boundedness.

In the Korean examples, more than half of the total length of the boundary is clearly open. In almost all cases, both the front and rear sides of *deochyeong-maru* are open to nature and the walls between the other rooms have many traditional Korean folding doors finished with paper. Regarding the boundary in Turkish examples, it often has more closed conditions with less than one side of the *sofa* space being fully open. Nevertheless, they present many windows that create visual connection between the *sofa* and its surrounding rooms. Based on the previous analysis, the difference in boundedness of these two type of intermediate space is closely related to the differences in the houses' planar composition: while Korean houses are constructed in the form of a single-layer wing house extend in the longitudinal direction, its front and back surfaces directly facing the outside environment, Turkish houses have a multi-layered plan, where the *sofa* is normally

located in front of a row of rooms and thus the area contacting with the outside is often reduced.

In terms of "placeness", the study concluded that the *sofa* presents a better sense of place than the *maru* because of its higher number of walls with long benches attached as well as floor height. People in *sofa* can recognize all sides and corners of the *sofa* space since it is normally designed as a single specific volume. Moreover, in some cases the *sofa* had an *iwan* space in the deepest area between rooms that further increased the sense of "placeness" (T-2, T-3).

Despite also being considered an enclosed space, the Korean *maru* is surrounded by several three-dimensional architectural elements such as a row of columns, eaves, and edges of a heightened wood floor rather than walls and banisters. These barrier elements therefore form vague spatial boundaries increasing the spatial quality of "plurality" but not as placeness. Table 11 presents the results of the three sub-categories of the openness category.

The difference in placeness and plurality results from their different architectural structures. i.e., while Korean houses are roof-oriented buildings, Turkish houses are wall-oriented buildings which directly form the placeness and

Table 8 Arrangement diagrams of cases.

Korean <i>maru</i>	K-1	K-2	K-3	K-4	K-5
Turkish <i>sofa</i>	T-1	T-2	T-3	T-4	T-5

Table 9 Comparison of arrangement of intermediate spaces.

	Similarities	Differences	
		<i>maru</i>	<i>sofa</i>
Form	- Rectangle area with variations	- Rectangle (<i>daecheong</i>) + Linear branch (<i>toenmaru</i>)	- Variable long rectangle + additional rectangle of <i>iwon</i> (T-2, T-3)
Composition	- Space between indoor and outdoor spaces	- Parallel composition of cognate space units - Biased and room-surrounding intermediate spaces	- Converged independent rooms around central intermediate space - Independent intermediate space
Hierarchy	- Central symbolic space	- Conceptual hierarchy of spacious <i>daecheong</i> and functional <i>toenmaru</i> - Contradiction between enclosed rooms and opened <i>maru</i>	- Hierarchical spatial structure centred by symmetrical form of <i>sofa</i>

Table 10 Openness towards indoor and outdoor diagrams of cases

Korean <i>maru</i>	K-1	K-2	K-3	K-4	K-5
Turkish <i>sofa</i>	T-1	T-2	T-3	T-4	T-5

Table 11 Comparison of openness towards indoor and outdoor.

	Similarities	Differences	
		<i>Maru</i>	<i>sofa</i>
Boundedness	- More than one side open; Multiple doors and windows connecting to the neighbouring rooms	- Two sides (front, rear) open - Less than half of the space is bounded by walls - Flexible bounding walls with full sized folding doors - Ambiguous boundary (with various architectural elements)	- One side (front) open, No open (T-5: exceptional case) - More than three sides bounded by walls - Porous bounding walls with many windows - Clear boundary lines
Placeness	- Various architectural strategies to transform the passage space into the place where events happen	- Sense of placeness created by structural elements (columns, eaves, level differences)	- Sense of placeness resulting from the well-defined boundary walls (<i>iwan</i> : T-2, T-3, Inner sofa: T-5)
Plurality	- Multifunctional space combining both inside and outside spatial characteristics	- Well-mixed plurality of inside and outside by penetrating natural flows through open structure	- Controlled plurality of inside and outside by inducing natural flows into interior space

induce plurality through the introduction of outside through the openings and windows.

3.3.3. Connectedness with indoor and outdoor

In the connected/disconnected category, the study analysed the unseen flows across the boundary of intermediate spaces (Table 12).

The study found that the movement in a Turkish house is sequential, but complex and flexible in the case of Korea. In Turkish cases, the movement starts from a stair or one entrance, passing the *sofa* and ending in a room. In Korean houses, there are multiple entrances to *maru* instead of single one, which means people can access it through various routes. Through this analysis, it could be said that traditional Korean housing has shallower spaces, while Turkish housing has deeper spaces.

The resulting sequential movement of Turkish houses allow people to experience distinctively phased spaces, while feeling the spatial continuity through windows. In contrast, spatial continuity is more directly experienced in a Korean house due to their spaces and sequences being not only more continuous, but also presenting a variety of penetrating views. In the case of *sofa*, lateral directionality is rather prominent since the flow of porous but strong walls between *sofa* and rooms are dominant in the space (Table 13).

Again, all these differences result from their structural difference and composition. While the *maru* has a column-beam system opened in multiple directions without borders, allowing multiple accesses and flows: a *sofa* has a wall-based system that reduces its accessibility and spatial continuity and thus provides a phased spatial experience. In

Table 12 Connectedness with indoor and outdoor diagrams of cases.

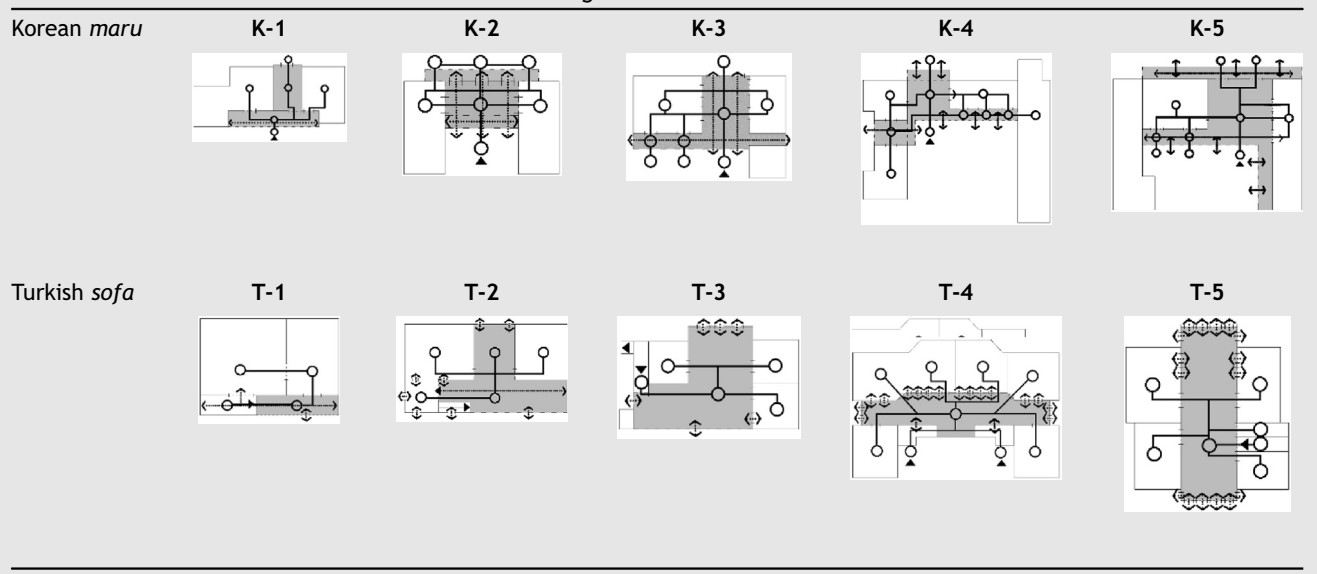


Table 13 Comparison of connectedness with indoor and outdoor.

	Similarities	Differences	
		<i>maru</i>	<i>sofa</i>
Accessibility	–	- Two sides direct access from outside - Shallow space with multiple direct accesses distributed linearly (<i>toen-maru</i>)	- Outside access through a stair and sequential access to inside rooms
Continuity	–	- Continuous experience of change from outside to inside - Visual continuity through openings	- Clearly distinctive phased experience of each spaces - Supplemental visual continuity by repetitive windows on walls
Directionality	–	- Penetrating central flows on intermediate space (<i>daecheong</i>)	- Lateral direction by form of sofa and walls

a Korean house with a single-layer plan, the main axis penetrates the building through *daecheong-maru*, whereas the main axis of a Turkish house is presented by the linear shape of *sofa*.

4. Discussion

Through comparative analysis of the three categories, this study explored the characteristics of the intermediate spaces of traditional housing in Korea and Turkey to search for architectural strategies that might help resolve current environmental requirements. The study identified various planar forms and architectural elements of traditional intermediate spaces that present spatial and environmental qualities.

Generally speaking, Korean *maru* is more open and connected to nature than Turkish *sofa*. However, *sofa* has better placeness quality as a space for family gatherings while its various openings supplying the controlled connection with nature. In summary, while the *maru* has the characteristics of contradiction between solid rooms

and void intermediate space even in monotonous structural repetition, the *sofa* presents an apparently hierarchical spatial composition leading attached rooms. Moreover the *sofa* often has a better placeness quality, whereas the *maru* usually presents better plurality quality due to actively mixing both the inside and outside environment. Finally while the *maru* often presents a clear spatial continuity, the *sofa* produces a sequential spatial experience.

The study suggested that these differences are mainly the result of their different structural systems and architectural compositions which reflect the relationship between intermediate spaces and not just neighbouring functional spaces but also outdoor areas. The boundary condition of intermediate spaces was adjusted by various elements such as walls, banisters, doors, and windows complementing the mediating qualities of spaces. Table 14 shows the spatial qualities of *maru* and *sofa* according to the three categories suggested.

Considering the similarities between *maru* and *sofa*, we can suggest two general possibilities of the enlarged intermediate space in a house. First, the intermediate space

Table 14 Overall comparative analysis of intermediate spaces.

	Similarities	Differences	
		<i>maru</i>	<i>sofa</i>
Arrangement	- Enlarged intermediate space as a symbolic centre of a house	- <i>Daecheong</i> as biased centre with <i>toen-maru</i> as linear branch - Contradiction between closed rooms and opened <i>maru</i> in repetitive structural units	- Independent designed sofa with attached separate rooms. - Hierarchical spatial composition of central and symmetrical sofa and surrounding rooms
Openness	- Many doors and windows for connection with rooms	- Vague and flexible boundaries by architectural elements (columns, eaves, door-wall, level differences) - Indirect placeness and well-mixed plurality of inside and outside	- Clearly bounded by porous walls and banisters - Directly enclosed placeness and controlled induction of natural flows
Connectedness	–	- Shallow space with direct and various access - Continuous spatial experience with direct connection by multiple penetrating views	- Deep space with sequential linear access - Phased spatial experience with fabricated continuity by visual connection through openings

can be a center of a house where family members meet the nature as well as each other when its size and location is properly designed. It may not be necessary for the place to be an outdoor space even in our contemporary circumstances. Secondly, the well sized intermediate space tends to become a passage of various flows. Circulation and visual connections as well as the natural flows such as sun light and wind would gather here. It may demand certain architectural complements to prevent the space from just flowing.

In a sense, the *maru* can be thought as an “opened room”, which occupies one or two modules in the middle of a row of rooms. It is a deep roofed space with penetrating flow that links a front courtyard with a back garden. On the other hand, the sofa can be thought as an “enlarged corridor”. Its oblong shape is defined by walls with many openings. It is still a corridor that connects many rooms, but an intermediate space between indoor and outdoor at the same time where family members gather. We can suggest that the opened room and enlarged corridor as two types of the intermediate space in a house, the former being called as “opened type”, whereas the latter being “closed type”.

When an intermediate space is suggested as a void between solid, it would be called the opened type. Its merit is the active relationship with nature. It can induce the direct flow of nature into the house, but the placeness quality for people’s gathering and the identity as a central space would weaken for it. The space need to be clearly defined by using some indirect architectural strategies, i.e., by applying a simple geometrical shape, repetitive columns, roof, eave, and elevated floor. To control various flows of nature, removable wall of doors could be added.

When an intermediate space is suggested as an enlarged corridor attached to a row or rooms, it could be called the closed type. It can be independently shaped and so have a clear identity as a core space of a house. However, its relationship with both the nature and other rooms may not be enough for an intermediate space. Surfaces directly contacting outdoor need to be maximized, and various doors and windows to neighbouring rooms need to be applied for the sake of connectedness quality of the intermediate space. If the space is linear and narrow, some fixed furniture can be suggested to increase its placeness quality.

The essential finding from the opened and closed types is that rooms and corridors of a house could be transformed into intermediate spaces with various spatial possibilities. This study tried to elaborate architectural features and spatial characteristics of such multi-functional intermediate spaces so that contemporary architects can conceive improved spaces mediating indoor and outdoor spaces in their housing design. The aim of this study is to inform architects of the spatial and environmental advantages and disadvantages of various types of intermediate spaces.

5. Conclusion

The study examined traditional houses of Korea and Turkey to figure out relevant architectural strategies for contemporary housing design. In spite of their long distance apart, many spatial and structural similarities could be found through drawings, photos, and related research materials.

Korea and Turkey were found to recognize the significance of the intermediate space for the reasons of both spiritual meaning and practical use. Korean *maru* and Turkish *sofa* are the result of such an endeavour to attune the quality of the intermediate space as a spiritual and practical space at the same time. Their scale, form, location, connection, and decoration were delicately adjusted to local conditions and culture. Although their solutions showed differences, *maru* and *sofa* both attempt to resolve the same issues imposed on the space between inside and outside.

In general, the differences discovered through the study seemed to come from their stance on the interactions between open and closed, connected and disconnected, stay and flow, and many others. By using planar diagrams representing certain characteristics as intermediate spaces, the study found that the *maru* stressed spatial continuity and connectivity while the *sofa* emphasized spatial hierarchy and the placeness quality. *Maru* and surrounding rooms have blurred boundaries, originating clear spatial contradictions and a plurality of characteristics. While *maru* is borderless allowing continuous views and movement, *sofa* has a variety of openings that ensure the quality of visual continuity as the intermediate space.

For the design of intermediate space in modern architecture where various structural systems and plan configurations are mixed, this study may be relevant to find appropriate spatial characteristics according to each condition. It is also expected to help to find new possibilities for intermediate spaces in the design of terraces, balconies, decks, atriums, and halls, which are recently highlighted in the context of environmental issues and pandemic situations. Passive environmental control methods responding to solar radiation, seasonal variation, and thermal adaptation should also draw inspiration on tradition architectural strategies that optimize arrangement, openings, and connections of intermediate spaces (Kim, 2017). The merit of traditional housing is that its spaces resolve not just environmental requirements but also functional and symbolic needs at the same time.

The three categories and nine sub-categories extracted from existing studies and the common characteristics of traditional intermediate spaces will be useful as one of the basic frameworks for analyzing and evaluating various intermediate spaces in modern architecture. Theoretically, it may be used to reinterpret and develop the discussion of in-between space, which has been proposed to overcome modern architecture, from the perspective of architectural traditions.

This study has the limitation that it is a data and document investigation without site inspection. We had to limit ourselves mainly to planar analysis because drawings were the most reliable sources that could be reproduced, analysed, and compared. It would be a meaningful next step for the study to precisely examine the multidimensional qualities of various intermediate spaces when site inspection is possible. There is also the limitation in selecting only two countries for the comparative analysis. In the future, it will be meaningful to examine and compare the intermediary spaces of traditional houses in various countries. Furthermore, it will be interesting to try to understand and analyse concrete examples of intermediate spaces in modern architecture in connection with traditional ones.

Declaration of competing interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Acknowledgments

This research was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean government (MSIP), grant number 2019R1F1A10609421F1A.

References

- Bozkurt, S.G., 2018. An Examination of the Characteristics of 19th Century Traditional Turkish House Gardens in Gurun (Sivas) District. *A+ArchDesign* 4 (2), 11–22.
- Doh, K.H., 2009. A study about spatial experience on intermedia space of eco-architecture. *Journal of the Korean Digital Architecture Interior Association* 9 (1), 19–29.
- Eldem, S.H., 1954. Turkish house plan types. *Pulhan Matbaasi Istanbul* Pulhan Matbaasi, Istanbul.
- Erarslan, A., 2018. Vernacular architecture and identity. Traditional ULA houses, Turkey. *Pro Ligno* 14 (3), 36–49.
- Hassanpour, N., Soltanzadeh, H., 2015. How traditional ottoman houses affect contemporary architecture in Turkey. *Bagh-e Nazar* 12/ (36/ Dec/ Jan), 47–60.
- Jeon, B.H., 2016. A Cultural History of the Korean House. *Academy of Korean Studies*, Korea.
- Kim, E.Y., 2017. An analysis on the passive environmental control methods of Korean traditional architecture. *Journal of the Korean Institute of Culture Architecture* (57), 237–235.
- Kim, H.J., 2020. The planning characteristics of private external space in multi-family housing. *Korean Association of Family Association* 36 (2), 13–24.
- Kim, Z.I., 1990. Meaning and transfiguration of Maru/Daechong space in the modernization of housing in Korea. *Journal of the Korean Housing Association* 1 (1), 27–35.
- Matsushita, S., 2004. Comparative Study of the Structure of Traditional Timber Housing in Turkey and Japan. Middle East Technical University, Turkey.
- Min, C.G., Lee, Y.S., 2009. A study on the public space with re-definition of infrastructure based on the concept of the intermediate space, Korean Architecture Association. *Journal of the Academic Presentation Conference* 29 (1), 297–300.
- Oh, K., Ahn, W., Jeon, Y., 2008. A study on the concept of “in-between” in Aldo van Eyck’s architecture- focus on the post-war CIAM. *Journal of the Korean Institute of Interior Design* 17 (1), 19–29.
- Park, J.Y., Yoon, D.S., 2018. A study on the renovation of university building – focused on the space of intermediate, Korean Architecture Association. *Journal of the Academic Presentation Conference* 38 (1), 263–266.
- Smithson, A., Smithson, P., 1970. *Ordinariness and Light*. The MIT Press, Massachusetts.
- Son, H.S., 2006. Study on the Plan of Commercial & Cultural Facilities that Apply the Concept of Interior-Exterior Intermediation Space. Yeungnam University, Korea.
- Van Eyck, A., 1976. *Miracles of Moderation*. Eidgenossische Technische, Zurich.
- Yi, K.U., 2015. *Hanok: the Traditional Korean House*. Architectural Publisher B and Youlhwadang Publishers.
- Yoon, J.W., 2002. A study on the types and symbolic meanings in the pattern of the Korean traditional house. *Journal of the Korean Housing Association* 13 (5), 43–50.
- Yoo, Y.E., 2005. A Study on Adaptation of Traditional Expression in Residential Design by Analysis of Korean Traditional Space Elements. Shuming Women’s University, Korea.
- You, B.Y., 2013. A Study on the Maru as a Boundary Space by Boundary Concept in Korean Traditional Residential Architecture. National Transportation University, Korea.
- P. Nani & L. F. Robert, 2018. *Hanok: The Korean, House*, Tuttle Publishing.
- Y. Hosaka, trans. by J. Lee, 1999, *Boundary, Form, and Architectural Structure*. Korea Industrial Training Center, Seoul.