

ABSTRACT

O. INTRODUCTION

This dissertation focuses on the study of domestic spatial organization, specifically on the analysis of contemporary housing. Being the Courtyard one of the elements traditionally found in our *modus vivendis*, but somehow forgotten or regarded as inoperable by urban contingencies of our time, it is intended, through the spatial analysis of contemporary Japanese houses characterized by the reintroduction of the courtyard, to demonstrate the possible systematization of new solutions to validate it.

The theme of the dissertation deals with the junction of three fields of interest:

Firstly, the relationship established between culture and architecture, focusing on housing as a mean to transport spatial conventions and usages. The domestic space reflects the social system, and by that, the study of different systems inevitably leads to the identification of different results. Thus, by contrast, the study of housing experimentation in different cultures from our own but that share similar problems, reveals patterns that may offer stimulation for the constantly evolving issue of the living concept.

Moreover, housing is responsible for the creation and development of rituals and comforts that are associated to domestic life, and thus, has evolved not only as a space detached from public life, but as a refuge. In this sense, the courtyard, as an element that links housing privacy and public space, is the second element of interest. Although not an essential element for basic living standards, the courtyard is assumed as a spatial organizer element in many Japanese houses. The understanding of the recurrence of this element usage in compact housing may provide clues to identify the common denominators in terms of housing standards in highly populated cities.

Finally it is justified the interest in the Japanese space. Contemporary Architecture in Japan follows a process of rapid maturation of Western concepts within rigid and intrinsic characteristics that define the Japanese culture. Today we are witnessing, in response to constraints of land and high housing densities, to a wide range of diverse and innovative ways of designing domestic space in urban lots. The studies intend to identify spatial solutions that may provide data about the design of domestic space.

Hence, proceeds the study of the courtyard's introduction at the formation of cities upon its appearance and its reinterpretation in the West in the twentieth century (Chapter 1). A second step explores the Japanese

culture and its interpretation of domestic space in traditional Japan and in modern city, with main focus on the process of Westernization of Japan (chapters 2 and 3).

After understanding all these features, the analysis of case studies is initiated. The projects taken into study were carefully selected from the consultation of all publication made between 1995 and 2008, by the magazine *Jutaku Kenchiku*, a specialized branch of the magazine *Shinken-chiku*.

With the case studies identified and framed, it was necessary to understand the method of analysis used. Thus, dismantling the methodology of the Space Syntax Theory (Hillier and Hanson, 1984), when combined with the studies carried out in the National Laboratory of Civil Engineering within the housing program, constitute the theoretical basis for analysis.

The interpretation and systematization of the acquired data shall lead to the identification of common properties in spatial configuration and its functional distribution, reflecting on the degree of permeability of spaces, their physical and visual accessibility, and their capacity to promote or constrain the relationship between users. The identification of these configuration systems intends to translate not only the potential of various types of use of the courtyard, but also original patterns of spatial transformation.

The ultimate goal is to generalize the results, and based on the information gathered, propose solutions for future projectual processes of single-family housing with courtyard.

1. THE COURTYARD'S FRAMEWORK

The definition of courtyard refers to its delimitation and formalization, and the various terminologies arise in association with the building program that embodies it.

This dissertation explores the courtyard towards its role in the global spatial configuration, specifically on the use to which it is confined. As such the study refers to both courtyard dwellings that are physically delimited, and the dwellings in which the courtyard takes a secondary function, or in which its boundaries are only suggested.

In the specific case of urban housing, its origins dates back to Ancient Orient (in Mesopotamia, Egypt, Indus and Chinese civilizations), yet a common element in Roman and Greek civilizations, the Islamic cities, in India, and in Japan.

There are identified four aspects that contribute to an uniform acceptance of the house with courtyard in the Orient: the consideration of psycho-social introversion on the housing, the economic factors, the climatic conditions, and finally the religious connotation.

In the West, literary and archaeological records indicate that since the beginning of the Fifth Century B.C. the house with megaron begins to be replaced in urban areas by the house with peristyle, an adaptation of the oriental courtyard house. The peristyle is the central courtyard surrounded by columns on various sides, that allows access to adjacent spaces.

The typical Roman house - the Domus - derives from a combination of the Etruscan atrium house and the Greek peristyle house, with its oriental heritage. As a result, the Roman villa that emerges in the later time of the Roman Empire has two rectangular courtyards, the smallest known as atrium and the second, peristyle. The atrium, and the area that configures it, form a more public area, while the spaces surrounding the peristyle are more segregated and form the private area destined for the family's bedrooms.

Regarding the interpretation of the courtyard in the Twentieth Century, the research developed by Macintosh (1973) in the work entitled *The Modern Courtyard House* identifies three main lines of development of modern house with courtyard: the courtyard house in the United States, the Modern Atrium House based on the Roman Atrium House, and mass courtyard housing in northern Europe.

The American courtyard house, after the depression, takes the form of the binuclear house, which is later developed into the linear house.

The Atrium House remains unchanged in its base, but its use was programmed by many types of approach in Northern Europe in the last century. In result of its reinterpretation there are some issues pointed regarding the functional organization and illumination. On the other hand, since it is less acceptable for programming outdoor circulations in northern climates, circulation systems tend to result highly segregated or confusing.

The L-shaped courtyard house which incorporates a relatively wide courtyard that allows the low altitude winter sun to penetrate, is explored in northern climates, particularly by Meyer and Hilberseimer, within its unitary spatial organization and the possibility of multiplication of these units in solutions for economically profitable residential housing complexes. Consequently, innumerable urbanization solutions of courtyard houses were explored.

2. THE TRADITIONAL JAPANESE HOUSE

The first matter to consider is the weather, because it not only influenced the development of traditional housing, but is still one of the factors to consider in the design of contemporary housing.

Following it is studied the trend of reduction applied to the compact and flexible nature that the Japanese housing presents since ancient times. This is reflected in different ways of understanding nature and its cycles, and consequently leads to social patterns and consistent ways to dwell in within this comprehension.

In the third moment is analyzed the evolution of Japanese vernacular housing, with primary focus on the socio-functional dimension of the domestic space and particularly, the courtyard. The analysis is divided in several architectural styles that evolve along Japan's history, since the Heian to the Edo Period, after which Western influence starts affecting housing in Japan.

Since the traditional residential architecture has common traits that also respond to spatial concepts intrinsic to a common vision of the world, it's explored the connotations of spatial elements in Japanese space. Among them are presented the transitional space units, the movable sectioning elements and the typical elements of Japanese space that play functional and aesthetic parts. These reflect the stratified, abstract and deep character of the space, its ambivalence, the relationship between interior and exterior spaces, either in terms of symbolic separation or in terms of symbiosis between them, and the two-dimensionality.

3. THE JAPANESE CONTEMPORARY HOUSE

Two fundamental examples are presented on the approach of the courtyard: Casa Gilardi (1978) of Luis Barragán and the project on collective housing for Nexus World by Rem Koolhaas (1991). The first allows us to understand how the connotations of traditional Japanese space can be reinterpreted in modern projects, and the second one how the courtyard addresses issues of functional character, such as illumination and ventilation problems at high densities.

Then it is studied the evolution of housing space after the Meiji period, characterized by the introduction of Western culture, which marks the beginning of the process that led to the reinvention of Japan's way of dwell in.

After the First World War, the development of capitalist society and the increase in population density led to urban housing projects focused on providing better living conditions for the working / middle class. On the other hand it is also during this period that begins the reinterpretation of the housing core, suitable for Japanese climate and focusing on modern nuclear family.

In the post World War II, is promoted the purchase of property by the Housing Loan Law witnessing the effort of producing prefabricated houses in order to reduce costs through mass production . During this period, this law encourages the purchase of property for self use and provides loans to encourage the construction of smaller dwellings.

The demand for housing lots in these highly populated areas leads to four spatial solutions: courtyard, pilotis, open well and central core system. The use of modular elements is also one of the solutions found in this period, taking advantage of the flexibility it allows. In this period, the relationship between the city and housing is underexplored, since the main goal of prefabrication is the reduction of construction costs.

One of the most decisive moments in the history of the postwar housing is the government's decision regarding the construction of Danchi - buildings of collective housing for the middle class, incorporating a typical housing program, the 2DK.

Today's architecture descends from the "New Wave", a group of post-metabolists architects that instead of focusing on the radical change in society, concentrate on the correction of urban individual situations.

Once the evolution of domestic space during the twentieth century is understood, we analyze the urban situation facing us today. Hence, it's realized a framing of the legislation based on the planning of single-family housing, and the constraints and freedom that lead to today's Japanese cities.

In the majority of Japanese territory, the individual architecture defines the large-scale environment giving identity to each place, marked by the absence of strategy for planning at large scale.

The minimum conditions for the use of the territory depend on the category of each type of use to ensure the rational use of the property, but there are no proactive measures, strategies or policies. The fundamental principle is that there should be no rules where there is no obvious need for such . This way the use of the territory should be left to the will of the owner as long as there is no obvious discomfort to the outside.

This regulatory system also has influences in the urban disposition, such as cluttered landscape. This fact,

coupled with property tax system that leads to the subdivision of lots, the housing policy which encourages the new occupation, and the trend of reconstruction of residential structures, results in an architecture of consumption, in which properties are renewed every 30 years. This results in the absence of cultural continuity and memorial elements in the city.

4. CASE STUDIES

Searching for the widest variety of spatial settings, the aspects considered in the selection of case studies are those that offer fewer constraints on demand for various spatial solutions. They are: the courtyard delimitation or the relationship between the courtyard and the number of adjacent interior spaces; the relationship between the courtyard and outdoor public space, and finally, the number of courtyards.

The classification by type of usage, necessary to the characterization of the case studies, is based on the proposal of Pedro (2002).

The type of usage of the courtyard is not identified in the development of space analysis, since it is primarily necessary to identify the configuration of the dwellings, in order to understand how their properties leverage the use of the courtyard.

It becomes necessary to choose a methodology to analyze how a spatial system is related, that is, in terms of abstract properties of topological nature and not of spatial geometric properties. In this sense it is used the methodology of Space Syntax.

The space syntax can be understood as a theoretical-methodological support that, in the context of morphological analysis applied to architecture, allows the study of the relationship between society and the physical form of space. In this sense we use three types of representation of the referred method: Convex Maps, graphs and Isovists.

The quantification of the data from the elements of representation is divided into various types of analysis. Based on the convex maps, are performed three types of analysis: the degree of ringness, the degree of openness and the degree of functionality

Regarding justified graphs, are analyzed the sectors of space, according to the representation technique developed by Amorim, L (1997), entitled "Sector Analysis".

Syntactic relations to be analyzed from the graphs are characterized through the properties of connectivity, spatial control and depth, and the quantitative data to withdraw are spatial integration and depth.

Following, the space use condition analyses the topological types of spaces, which according to Hillier (1999), are known as: A, B, C and D.

Finally, the analysis of permeability is completed with data from the visual connection between spaces. Therefore, it's accounted the Visual Connectivity and Integration. These informations are complemented by the Isovists maps.

The comparative analysis of the case studies allowed to identify similar characteristics in the configuration of spaces, in the part which each sector takes, and in the role of the courtyard. In this chapter these patterns are systematized, and lastly, are identified the characteristics of the courtyard inherent to each type of implantation.

Firstly, the stratification of spaces by the convex elaboration was considered as a general characteristic, in opposition to the closure of spaces. This stratification results from the use of transparent vertical elements, the positioning of furniture, the use of isolated vertical elements, the use of movable separation elements, and also from the three-dimensional space, that is, the prolongation of rooftops, differences in free-height or level flooring and incorporation of vertical voids.

The stratification of space is materialized in the following spatial properties:

- Fluency in the various sectors - particularly in courtyards, and in social and mediatory spaces;
- Reduced level of spatial control in movement, but wide visual range;
- Depth between spaces within the same sector;
- Depth to public outdoor space;

For the functioning of these spatial systems it is used the multipurpose space. This understanding may be related to the notion of domestic space as the space's private unit, in which the city generally represents public life and the house the "bedroom" (Ashihara, 1989). The attitude itself of removing shoes, the introverted centripetal settings of the residential districts explain this attitude. Still in this sense, the

symbolic separation of outdoor space, where the social control plays a strong role, and the ambivalence of space. Through strategies like spatial compression of service spaces, that free the remaining spaces, or the compression of contiguous functional units that decrease the spatial hierarchy, the ambivalent use of space is boosted and so its interpretation becomes more subjective.

Regarding the characteristics of each sector, it is observed that the social space enhances the movement between different parts of the house. Since community spaces are essentially mediatory spaces, the occupation of social space turns out to be more a matter of decision or crossing, than convenience and control of housing.

In the spatial system, private spaces are considered as occupation, lacking in control over the remaining functional units and movements. However, they are also presented in large scale as spaces of transition, creating private, contained and secreted units, located in ringy layouts. Private space becomes more interesting apart from other sectors of housing.

Service spaces are essentially occupational spaces, that poorly control the rest of the house, visually and physically. However the kitchen is an exceptional case, as it forms rings of permeability with other sectors.

The mediatory spaces allow the understanding of the spatial organization in terms of fluxes and movement intersections of the users. Among the solutions encountered, the less common is the sequence between sectors through mediatory spaces, and the most common is the sequential or ringy system between different sectors without using mediatory spaces of connection.

In the analysis of the case studies it is possible to interpret the function of the courtyard in concerns of space configuration and domestic activities. Consequently, are assigned five essential roles to the courtyard:

- as a central direct distribution across various sectors
- as a space-crossing
- as a localized ring
- as a located ring and communication with the main distribution axis.
- as an occupancy space
- as an approaching space between the interior and the outdoor public space.

Finally we return to the original criteria for the selection of case studies, that is, through variations at the

implantation level, and referring the characteristics found for the type of usage and permeability, and how the outdoor interferes with the spatial configuration.

5. CONCLUSIONS

The Japanese space and its culture, is characterized by a strong ambivalence and although the study has allowed an approach to its understanding, the interpretation of the results reflects the cultural context of the author.

The courtyard, whose definition depends on the elements that involve it, is a spatial unit capable of responding to several requests, depending on the connotation that it is associated.

As an element that emerges in the history of urban housing associated with introversion of domestic space, it demonstrated that can be associated with different levels of privacy, softening the distinction between public and private space.

Also, the courtyard that is initiated in history as a point of organization and distribution that isolates the house from outdoor space is here considered as one of the housing units, not performing a main role in the hierarchy of space, and at a larger scale, only as one of the units of space that define the urban landscape.

As a result, the following research thematic are suggested for future investigations:

- Functional analysis of the courtyard in single-family housing in a larger scale, where this element is considered as urban unit;
- Spatial analysis of single-family housing that reinterpret the courtyard in its delimitation from the public space, making it more permeable;
- The courtyard as a space for carrying out domestic activities in community.