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# The Law of Conservation of Activities in Domestic Space

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## Abstract

Until the early twentieth century, for hundreds of years, the housing prototype in Seoul has been a courtyard house where a central open space is surrounded by building blocks and fence. Through the twentieth century, as new modern types of houses emerged, the housing culture began to change and consequently this prototype began to make transformations. This evolutionary process necessarily accompanied the functional change of room activities; some rooms acquired more activities and some lost them; and some has lost all the activities and became extinct. This paper attempts to analyse the housing evolution in Seoul by measuring the "space-activity interactions". Through the analysis, it is found that, at the collective level, the basic home activities are preserved through the formal change of the house. Without leaving the domestic field, they are decomposed into separate elements, re-distributed into other spaces, and then re-combined to characterise a new type of space. This is the internal spatial mechanism by which the old house is gradually transformed into a new house.

**Keywords:** house in Seoul; evolutionary process; transformation; space-activity interactions

## 1. Introduction

Many studies have been made on the subject of Korean domestic space. Some of them focused on its formal characteristics from the morphological perspective (e.g. Joo, 1980; Kim and Park, 1992) and others on its usage patterns from the ethnographic perspective (e.g. Kim and Yoon, 1992). In recent years, more refined researches have synthesised these two subjects to illuminate the relationship between the morphology and its usage patterns, and some went further to reveal how this relationship has changed through time (e.g. Choi, 1996). There has been, however, a dearth of research that defines the transformation process in terms of the "action of activities".

Cultural change in society accompanies the change in housing culture, and this entails the change in room activities. In this respect, it is believed in this study that, when the old house is compared with the new house, a more precise result can be generated by mapping their activities, rather than their room labels. Thus, by focusing on activities that are the "most useful entry point" for relating culture with the built environment (Rapoport, 1976, 1990), this study aims to illuminate the evolution of housing culture in Seoul in the twentieth century.

It was after the Korean War (1950) that the mass construction of the modern-style housing began. In less than a half-century, the house form and culture in the country have been radically transformed. Among the new house types, it was the apartment housing that proved, economically and culturally, to be the fittest in adapting to the middle class need. It is reported that the first apartment building in Seoul was built in 1958, and the first apartment scheme developed on a site-planning concept was initiated by KNHC (the Korea National Housing Corporation) in 1963. In the 1990s, after only three decades, it became the most dominant housing type in the city. If it was the traditional central courtyard house that moulded the typical domestic life of Seoul until the 60s, now it is the modern apartment house that takes the prime position.

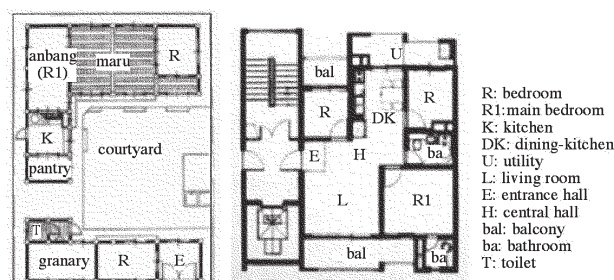


Fig.1. Traditional Urban House and the Apartment House

From Fig.1., it is evident that these two housing types are completely different. The central courtyard house, which is inward-looking, has turned into the self-contained modern apartment house, which is outward-looking. What has been changed is not only the overall form. Some spaces like the courtyard

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have disappeared and some have emerged; those multi-functional rooms like anbang and maru of the old house have been endowed with new names, main bedroom and living room, due to their more specialised functions in the modern period. This is a situation where the continuity and change cannot be measured simply by mapping equivalent rooms in the old and new houses. In other words, for example, the old anbang and the modern main bedroom are not the same even though they share a considerable amount of characteristics. To deal with this subtle problem, as mentioned in the beginning, it is needed to focus on the space-activity interactions; how the activities in each partitioned space are preserved, migrate, and finally re-group to form new spatial frameworks.

In the following sections, two phases of analyses are made to examine the four distinct stages of housing evolution that are characterised by: the traditional urban house (built until 1960); the early modern detached house (from 1950s to 60s); the first 3bed apartment house (1968), and the typical 3bed apartment house (from 1980s to 90s). In the first phase, diagrams are drawn to illustrate the topological positions of activities of each housing type. From these, it is possible to see the positional change of individual activity through the evolution. In the second phase, this positional change is precisely measured by the space syntax method which will be explained later. Sample plans are chosen based on their dominance in the market. In the case of the apartment houses, samples are taken from the 'three-bedroom staircase access type' which is statistically the most popular in the city.

## 2. Traditional code and its transfer to the early detached houses

The traditional urban house was developed in Seoul about the 1930s when there was a growing need for city workers' housing (Song, 1980). It takes a simplified format of the traditional layout in order to fit into a small and tight urban plot that normally borders one street and three neighbours. While the layout could vary from one site to another, it typically contains a unique structure of "L" shaped block that encloses the main functional rooms as shown in Fig.1. For hundreds of years, this block has been the distinguishing feature of the houses in Seoul (Joo, 1980) and was therefore naturally inherited by the new urbanised house in the early 20th century. Through the repeated production, this structure presumably has been accepted to the people as an ideal arrangement of key spaces. Within the compact layout of the traditional urban house, this "L" shaped block had to be placed along the site boundary around the central courtyard. As a result, it was the direct link between the block and the courtyard that held the essential space-activity interactions, and this can be put into a domestic code diagram as in Fig.2.

The diagram linking the four main spaces, anbang, maru, a kitchen and a courtyard, can epitomise the spatial characteristics as well as the topology of these spaces. Those two living spaces on top were named after their user (anbang, a wife's room) and construction material (maru, a raised wooden-floor) unlike their modern counterparts, main bedroom and living room, and this may be due to the fact that these rooms could not be associated with particular functions. In the diagram, representative activities of each space are included within the circles. These room-activity mapping could be controversial in that a type of plan can accommodate a wide spectrum of living styles. However, as the purpose of this study is to get a big picture of the evolutionary movement of domestic activities, it seems appropriate to show the most widely accepted activities in the diagram (for detail, see Kang, 1992; Kim and Yoon, 1992).

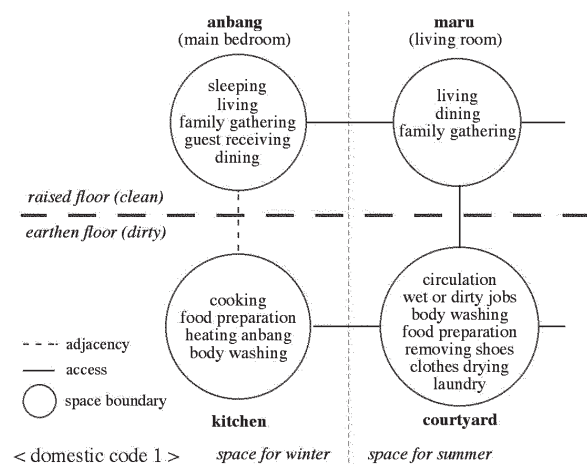


Fig.2. Domestic Code 1 from the Traditional Urban House

Rather loosely programmed, these spaces could accommodate various kinds of functions including providing support for the space nearby. The anbang and maru always support each other with living and dining activities, and the kitchen and courtyard, with body washing and food preparation. Since these concurrent activities tended to be scheduled by season, the anbang and the kitchen can be categorised as "winter spaces" and the maru and the courtyard as "summer spaces".

The kitchen was always directly adjacent to the anbang because the hot air produced from its fireplace, which is also used for cooking, was drawn under the raised floor of the anbang for heating. The maru was also raised to the level of the anbang – several steps' height above the ground – yet with the opposite purpose of passive cooling in summer. These two types of elevated structures were developed solely to control the interior temperature but, through long custom, they encapsulated the conceptual distinction of "raised clean living zone" versus "earthen dirty subsidiary zone".

This spatial code described above governed the housing culture for centuries with authority but, when

the new housing types were introduced from the mid-twentieth century, changes began to be made. Those traditional space-activity relations started interactions to make different combinations in new domestic settings.

Mass construction of economical modern houses began after the Korean War (1950) to meet the growing demand in many cities across the country. It was the first generation of modern housing development and many standard types of detached house plan were designed by ICA (International Cooperation Administration) and KNHC. Despite their varieties in plan design, they had some characteristics in common, such as the adjacency connections of R1-L-R (anbang-maru-another bedroom) and R1-K (anbang-kitchen) which arguably came from the traditional house layout pattern (Yoo and Cho, 2001). Fig.3. shows two typical standard detached house plans. If we focus on the four main spaces, it is found that these two houses have an identical spatial structure (domestic code 2 in Fig.3.).

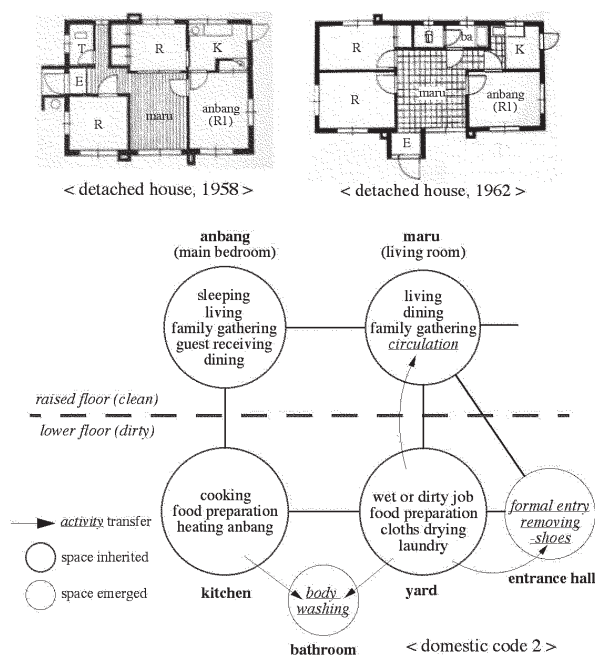


Fig.3. Modern Detached Houses and Domestic Code 2

Surprisingly, this topological structure looks very similar to that of the traditional urban house. Even though some new spaces – marked by thin circles in the diagram – have been added, the relations between the four key spaces are almost the same. The only change within it is the strengthened link between the anbang and the kitchen; they are now directly accessible from each other for utilitarian purposes. It can be said that anbang as a main dining room now takes the stronger role than the other rooms.

While the primary spatial links are maintained, some minor changes have been made. The entrance hall was attached to the maru to mediate the inside and outside,

thus taking away from the courtyard the activity of removing shoes. It is interesting to note that this "formalistic depth-increasing" in the shallowest part of the house – to emphasise the rites of "going into the house" – is quite contrasted with the "utilitarian depth-decreasing" between the anbang and the kitchen in the deepest part. Around this time, bathrooms began to be built within some houses, so gradually the activity of body washing slipped out of yards and kitchens.

In this phase of evolution, the maru became the most integrated space taking the function of circulation from the courtyard. Although this central room should allow many through-movements, it could still accommodate many activities as shown in the diagram owing to the traditional floor-sitting style of living. The maru, however, was destined to become a more independent space in the near future to be able to include the growing amount of western style furniture. In this respect, it can be anticipated that the function of circulation would be transferred, again, to another part of the house.

Compared with the urban traditional house, the overall plan morphology of these modern detached houses was significantly different. However, the traditional domestic code is still manifest; the same topological relation of the four essential spaces has survived to preserve the traditional way of living. Being the first generation of modernised homes that suggested a new way of enclosing the indigenous pattern of living, it is almost certain that they strongly affected the apartment house plans that followed.

### 3. Evolution of apartment house plans

After its first mass development in Mapo area in 1963, in only three decades apartment housing became the major dwelling type in Seoul. Now there are more than one million apartment units in the city accommodating more than a third of the citizens. The construction ratio of this dwelling type within the housing market kept growing to reach 90% in 1999 and it provided 51% of the housing stock as of 2000. One of the conspicuous characteristics of the apartment houses in Seoul is the existence of a strong pattern in the plans. In their study, Kim and Park (1992) found out, from the analysis of almost all apartment house units built between 1962 and 1990 in metropolitan Seoul, that only a small number of plans are adopted "constantly and ubiquitously". They identified these dominantly prevailing plans in relation to the floor area, construction body (public or private), and the year they appeared. Amongst them, only three bedroom plans are presented here for analysis (Fig.4.). The labels under each plan are from the authors' sorting method and here it is sufficient to know that the first letters "J" and "P" mean they are from the public sector (KNHC) and the private sector respectively, and the second letter "S" stands for a staircase type. Following the labels are



the years they appeared. A visual inspection reveals that it was KNHC that built most of the houses until the early 70s, and tried to develop and test more plans than the private sector. The private sector, in contrast, has only two typical plans, PS1-III and PS1'-III, which are duplicated within the public sector (see the dotted-line box in the Figure). Since these two plans were more repeatedly used in both sectors, it can be inferred that they make up a larger proportion of the apartment housing stock than any other types.

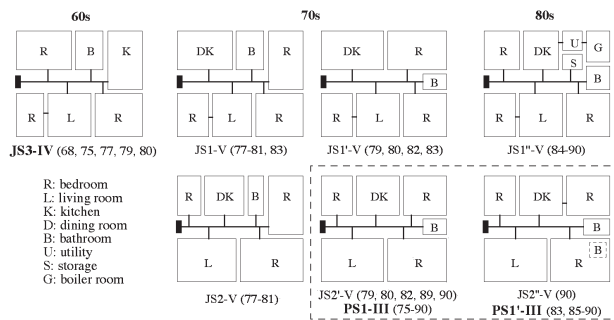


Fig.4. Typical 3 Bedroom Staircase Access Plans in Metropolitan Seoul (Reproduced from Kim and Park, 1992)

All the plans in the figure have the same circulation pattern, which is another strong feature of the staircase type apartment in Seoul. The entrance hall is always placed at one end of the middle row from which the central circulation hall is extended across the house demarcating the upper and lower zones. In real plans, however, it is often difficult to distinguish this central zone because, in most cases, it is fully open to the living room and the dining-kitchen without partitioning; thus it becomes a part of the fully interconnected public realm.

In this research, for consistency of analysis, this type of circulation zone will be regarded as an independent space with a label of central hall.<sup>1</sup>

When the seven plans in the figure are adapted to the domestic code format, surprisingly, only two types of code emerge (Figs.5. and 6.). Code 3 applies only to the earliest plan (JS3-IV) and all the other plans, in spite of their configurational variety, converge onto code 4. What makes those two codes different lies mainly in the status of the kitchen. In the earliest 3 bedroom plan, the kitchen still contained the traditional heating function, and for this, its floor was sunken and the main bedroom, which still carried all the important activities until this time, was directly adjacent to it to be best heated (code 3). Because of its lower level, which is always associated with the word "dirty", the kitchen could not be regarded as a proper place for dining. This problem was solved when a boiler was introduced and placed in a separate space (code 4). Owing to this technological improvement, the kitchen floor could be raised to the level of other living spaces, and this change greatly affected the domestic environment. For the main bedroom, this was an

important moment to break free from its centuries-old connection with the kitchen and turn it into a private space mainly for sleeping.

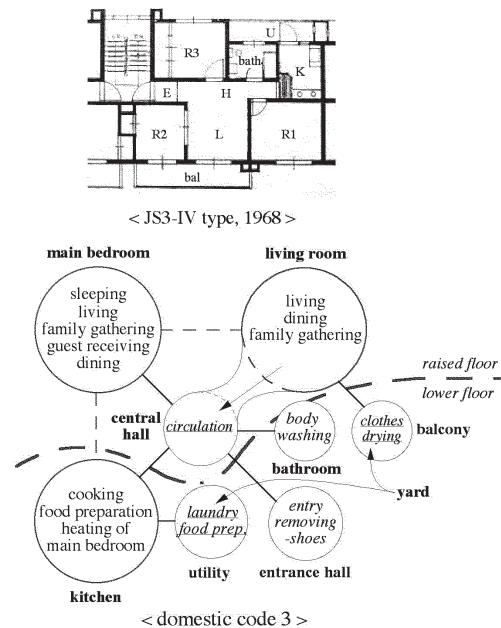


Fig.5. Domestic Code 3 and the Earliest Apartment Plan

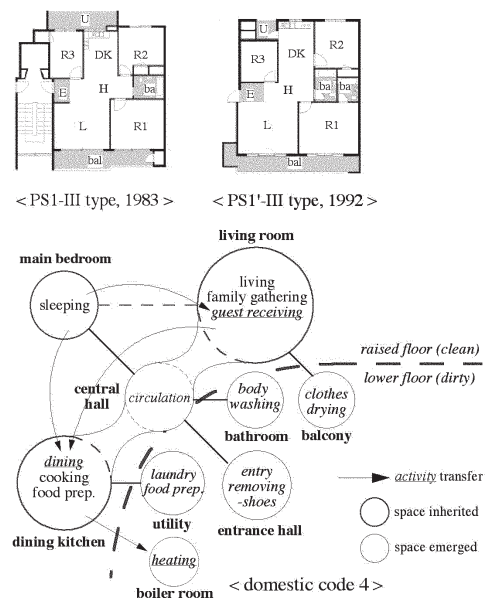


Fig.6. Domestic Code 4 and the Two Typical Apartment Plans

Owing to this remarkable change in its status, the kitchen becomes the only space that has successfully crossed the conceptual boundary between the "dirty low-level zone" and the "clean high-level zone". Code 4 further reveals that the kitchen absorbs the dining function and becomes a crucial axis of the public domain. As for the living room, though it has given the dining activity to the kitchen, its public function is much strengthened. Since the main bedroom ceases to be a multi-functional public space, all the parallel

functions in the living room are strengthened. In the course of the transition between code 3 and 4, therefore, the role of the anbang and the maru as two axes of public activities in the past has given way to the living room and the dining-kitchen in the modern apartment houses.

The biggest change at these stages of evolution is the disappearance of the yard that still featured strongly at the time of the earlier detached houses. Of the four essential spaces, now the main bedroom, the kitchen, and the living room are left with more or less changed functions. What is noteworthy here is that the kitchen and the living room, which used to be supported by the yard, are relying on the alternative spaces, the balcony and the utility room, in the apartment houses to preserve the activities of the yard.

#### 4. Tracing the routes of activities in evolution

Over-viewing the whole process, some important points can be summarised. The traditional link of the four essential spaces was still preserved in the detached houses of the 50s and 60s, but when it comes to the apartment houses all the relationships are re-arranged, and the yard disappears leaving small fragmented spaces to preserve some of its activities. The only indication that suggests the initial code structure is the adjacency between the main bedroom and the living room, which, like a rule, appears in every typical plan. The central hall emerges as a universal solution for the circulation in the staircase type apartments in Seoul, and it links the three remaining essential spaces. The function of circulation, therefore, has been transposed from the courtyard to the maru, and then to the central hall.

For the purpose of tracing the changing localities of activities through the time, this study uses space syntax method (Hillier and Hanson 1984). This method enables the conversion of a room's topological position into a mathematical value by which the more centrally located room will have a lower RRA value and the more peripherally located room a higher RRA value.<sup>2</sup> Hence, by means of RRA values each room position in a house can be represented as a point in a linear bar that shows the whole range of RRA values. The next four graphs illustrate the topological paths of the activities by means of RRA values (from Fig.7. to Fig.10.). Each graph shows the traces of activities that came from one of the four key spaces. Using RRA values which show the degree of integration, precisely how these activities are assigned their topological position in each phase of the housing evolution can be revealed.

First, Fig.7. shows the diachronic movement of the activities that once belonged to the anbang, the counterpart of the modern main bedroom. The five representative activities in the old anbang change their position in terms of RRA values but remain together in a single room until the third phase of the evolution,

i.e. the first three bedroom apartment house of 1968. In the fourth phase, as the kitchen develops into a dining-kitchen, the activity of dining moves from the anbang to the dining room. In this phase, the function of living, family gathering, and guest receiving that used to happen in both the anbang and the living room are more strictly confined to the living room in order to render the anbang a more privatised space for parents.

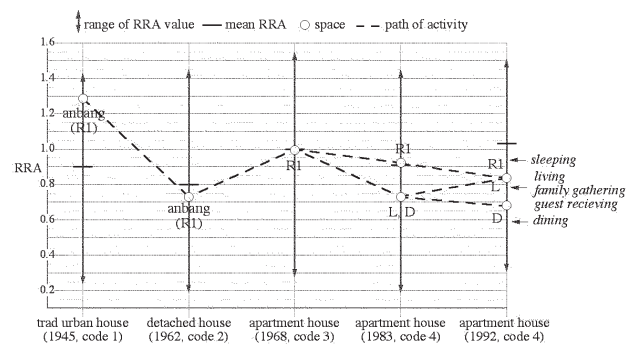


Fig.7. Routes of the Activities of the Anbang

Through the five phases of the transition, the five activities of the anbang are spread into the three spaces, the main bedroom, the living room, and the dining room. Therefore, through the space-activity interactions, the anbang becomes the most activity-depleted space amongst the four key spaces of domestic code 1 and this implies that it lost its traditional meaning as the most important space for the whole family. By looking at the overall transition of RRA values, it can be said that those five activities have migrated from the more segregated part of the house to the more integrated parts as time passes. Hence in the modern apartment houses, they tend to happen in more open and exposed places than before.

The old maru in the traditional house was the space for living, family gathering, and dining. All the way through their migration, these activities are kept lower than the mean RRA values, thus positioned in more integrated parts of the house (Fig.8.). They move to the lowest level in the second phase when the maru inherits the function of circulation and becomes the most integrated space due to the demise of the central courtyard. The advent of apartment houses has endowed the maru with a new name, the living room, and this implies its status change to a more independent living space furnished with western furniture. The activity of dining is absorbed to the dining room from phase four when the floor level of the room is raised to become a high-level clean space.

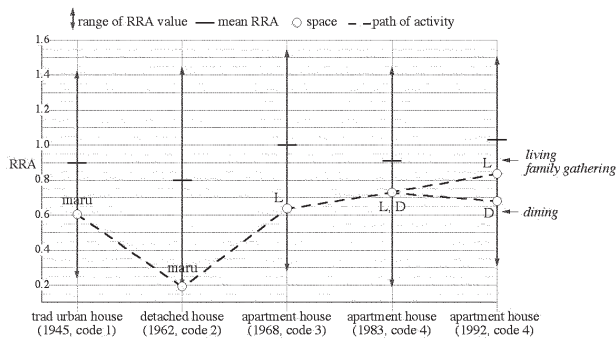


Fig.8. Routes of the Activities of the Maru

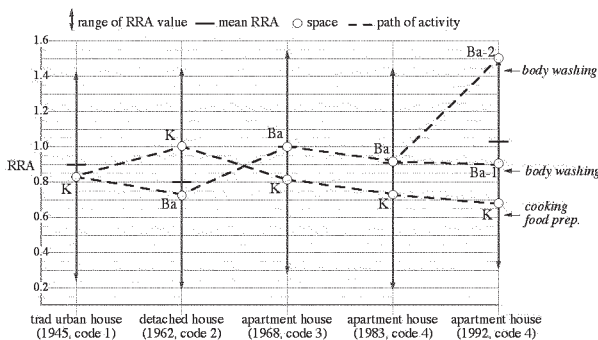


Fig.9. Routes of the Activities in the Kitchen

In the traditional courtyard house, the kitchen was the space not only for cooking and food preparation but also for body washing in winter and bathing in all seasons. As soon as the modern detached house was equipped with a bathroom, the activity of body washing was separated from the kitchen (Fig.9.). In the last phase of the evolution, the path of this activity bifurcates, as the second bathroom attached to the main bedroom absorbs this activity from the most segregated position. Following the modern trend where the kitchen becomes a pleasant living space for the whole family, the activity of cooking and food preparation moves downwards in the graph to the more integrated central area.

The most startling change of all is the transformation of the courtyard. The multiple role of this outdoor space has been successfully re-distributed into the five newly emerged rooms in the modern apartment house as previously illustrated in the domestic code diagrams. The utility room, the balcony, the entrance hall, and the bathroom have inherited its activities, and the central hall is now supporting its function as a circulation core. Again, this process of "activity relocation" can be better understood when seen through the route graph (Fig.10.). The activities derived from a single space, the courtyard, are migrating through the different routes and spread across the domestic field. It is evident from the graph that the activities that once belonged together in the most integrated space are diverging gradually towards the other end, the most segregated space. In fact, it is a natural result caused by

the reversed characteristics of the old and new house configurations. The main substitutes for the central courtyard, i.e., the balcony and the utility, are destined to be placed on the perimeter in apartment houses, and this location is likely to have higher RRA values.

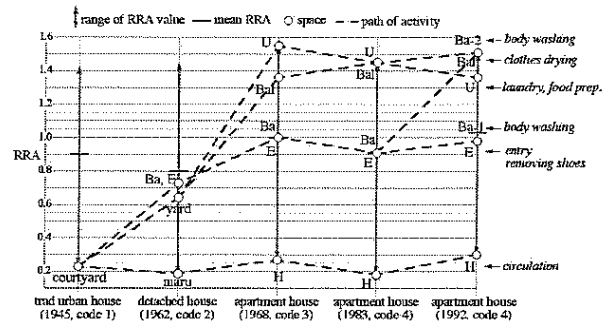


Fig.10. Routes of the Activities of the Courtyard

## 5. The law of conservation of activities

Fig.11. combines all the routes of the activities in the previous graphs without considering their RRA values. The four domestic codes are represented by the four vertical axes in which all the spaces that inherit the activities of the original four key spaces are arrayed. The size of the circle and the thickness of the line are proportional to the number of activities it encloses and transfers. When activities migrate to a space that is not equivalent to the original place, the connecting line between them is coloured grey.

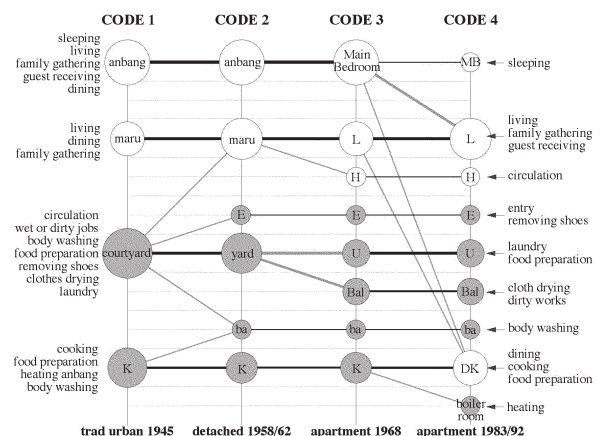


Fig.11. Routes of the Activities in the Traditional House

The activities on the far left side of the figure start to travel towards the right side as the evolution proceeds. By finding the same activity on the far right side of the figure, one can trace the route of that activity transfer. Comparing code 1 and code 4 directly, it is revealed that the activities that once were accommodated in the four key spaces in the traditional house are now instilled into the nine spaces. As moving from the past to the present, the domestic space is getting more segmented and each room's function more specialised.

Thus, it is visually clear that the proper functioning of the modern home requires more partition walls and designated spaces.

All through the housing evolution in Seoul, while the housing form and room functions have been radically changed, the basic home activities have been successfully preserved. Just as the law of preservation of energy in physics, basic activities are preserved inside the house and outlive the formal change of their container though the modern history of Seoul.

On a closer look, a more interesting phenomenon can be observed from Fig.11. When the lower level spaces such as the courtyard are coloured darker, the figure reveals another important pattern of the changing process. Regardless of the housing form and internal layout, those activities out of the lower level spaces are migrating to other lower level spaces, and those out of the higher level to other higher level spaces. Thus, activities seem to carry their old spatial properties to a new house. In other words, what has been preserved is not just the activities but the structural concept – the lower level and the higher level distinction in the old space. In the case of the courtyard, except for the central hall that succeeds only the positional role of the courtyard as a circulation core, those new alternative spaces have all inherited the low-level that has to be separated from the clean living zone of the upper level – though the level difference has been reduced to a few centimetres in the apartment houses. Therefore, when we look back at the four domestic code diagrams, it is found that the "raised versus lower" distinction keeps operating all the way through (Fig.12.). It is an irony that the lifted floor of the traditional house, which was originally designed for cooling and heating, is still alive in the modern apartment houses. The original functional mechanism has been severely changed but the secondary function, the clean-dirty distinction that was "acquired" through long practice, has been transferred to the modern homes.

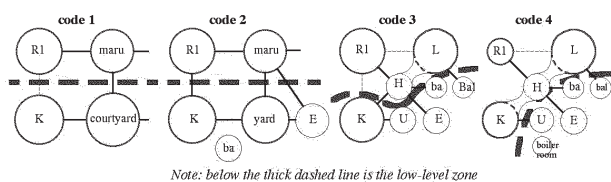


Fig.12. Boundary Between the High and Low Level Zones

## 6. Conclusion

From the beginning in the 60s, the aim of the new apartment housing development in Seoul was to modernise and enhance the people's living. For some planners, the old domestic culture was regarded as outmoded and unhealthy thus not suitable for the modern way of living. They thought the apartment house that came from the West should enclose the western style of living. In some of the earlier apartment

plans, they raised the floor of the bathroom up to the level of the living room, and provided radiators, instead of the floor heating, in the bedroom. When the residents moved in, however, they resisted the planners' intention; they had the floor level of the bathroom re-lowered in Hangang apartment housing in 1970 and installed hot pipes under the bedroom floor to restore the floor heating in AID apartment housing in 1974<sup>3</sup> (Zhang, 1994, Kang *et al.*, 1999).

People have accepted new housing culture and adapted to the new patterns of dwelling. What they have changed, however, was the framework of the domestic life, not the basic activities in it and their spatial properties. Hence, characteristics of the old activities have outlived the evolution process of material culture and the user's reaction described above shows that these values can persist through the formal changes.

The house is a solid object that encapsulates the potential activities of people. Once constructed, it can readily start to serve these known activities. Through the passage of time, however, the house starts to restrict, with its rigid frame, some of the inhabitants' unexpected activities that are constantly developing over time. As this negative condition grows, inhabitants first renegotiate the usage of each space; and then try to modify the built structure by removing or installing building components such as walls and doors; and at the end reconstruct the house for the re-distribution of the domestic activities (see Williams 1991). From the evolutionary perspective, home activities do not have fixed coordinates in space; they tend to float in space and find themselves in temporary positions through time, as fully discussed in this paper. Construction of a house, therefore, can be regarded as an action that freezes a certain moment of activity-distribution in space. Hence, it might be naïve optimism for an architect to dream about the everlasting housing plan that could accommodate ever-changing domestic needs. Likewise, it might be a futile effort for a modern functionalist to assign meaningful and unchanging functions to every inch of space available in a house.

Lastly, it should be pointed out that the evolutionary analysis of space-activity interactions for the future home has to necessarily include the dimension of technology and outsourcing. As the mechanical and electronic devices absorb more activities that demanded human labour in the past, it is anticipated that they would increasingly influence the space-activity relationship in the future. In addition, as an increasing number of homes rely on outsourcing for the house running chores, it is possible that more activities would find their place outside the house.



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- others is represented by lines. Then, the graph is re-arranged in a 'justified graph' format where the target point is placed at the lowest bottom and the spaces directly connected from it at one-step above it and so on, in order to show the relative depths from the target point. Next, the degree of 'integration' is mathematically measured, in three steps. First, the mean depth (MD) is calculated by summing up all the depths from the target point to all the others and dividing them by the number of the points less one. Second, relative asymmetry (RA) is calculated from the following formula in which  $k$  is the number of points:  $RA=2(MD-1)/(k-2)$ . This is to compare "how deep the system is from a particular point with how deep or shallow it theoretically could be" (Hillier and Hanson 1984, 108). Third, to deal with different sized systems, real relative asymmetry (RRA) is calculated by dividing the previous RA value by the RA value for the origin of a 'diamond-shaped' pattern:  $RRA = RA/D_k$ . The diamond-shaped pattern means "a justified map in which there are  $k$  spaces at mean depth level,  $k/2$  at one level above and below,  $k/4$  at two levels above and below, and so on until there is one space at the shallowest (the root) and deepest points." (Hillier and Hanson 1984, 111-112)
3. Hangang apartment housing was the biggest scheme at the time of its construction (between 1966 and 1971) with its various types of plans designed for the middle-class, government officials, and foreigners. The name "Hangang" seems to have been taken, since its site is located in Dongbu-Ichon-dong which overlooks Hangang, the central river crossing the middle of Seoul. The apartment name, "AID" was labelled after the Agency for International Development in USA that provides loan for the underdeveloped countries.

## Endnote

1. When this central circulation hall is seen as a part of a living room, any space syntax analysis dealing with Korean apartment houses would necessarily yield the same result: the living room always becomes the most integrated space. This typical way of analysis can be misleading because it blurs the living room's status change through time to become a more independent space by rendering this room an all time circulation core. Further, it is impossible to reveal the compositional logic of apartment houses in Seoul without the existence of the central hall as an independent compositional element. Be it large or small, all the staircase type unit plans are generated first by lengthening or shortening the topological distance of the central hall.
2. For the analysis, a house plan is converted into an access graph where each space becomes a point and its access connection to