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## Abstract

Traditional courtyard houses that moulded the typical home life of Seoul for centuries have been replaced by modern apartment houses in the twentieth century. On the surface, morphologically, these two are so different and there seems to be no gradual process for the transformation. This study, however, reveals that there were continuous and deliberate efforts to re-adapt the traditional living into the new frame of space. The Space Syntax approach is used to measure the varying degree of change in each stage of the evolution. Here, the “space-activity” interaction is the main idea that enables us to see what underlies the process. As the old rooms take different names and functions in the new setting, they bring about the recombination of their activities, and when this occurs repeatedly at each stage, it leaves behind “topological paths” from which the direction of the evolution can be measured. Further examinations reveal that the space-activity interaction arises not only at each partitioned-space level, but also at the collective-space level that is closely related to the traditional concept of binary opposition, i.e., “elevated clean space” versus “earthen-floored dirty space”. Finally, it is concluded that even the domestic culture that is engaged in a fast and intense transformation process still tries to preserve, underneath its surface, its old genotypical value and in the course of change there exist conscious and unconscious efforts to direct it.

## Keywords

Topological paths, space-activity interaction, urban traditional house, apartment house, domestic code, level distinction

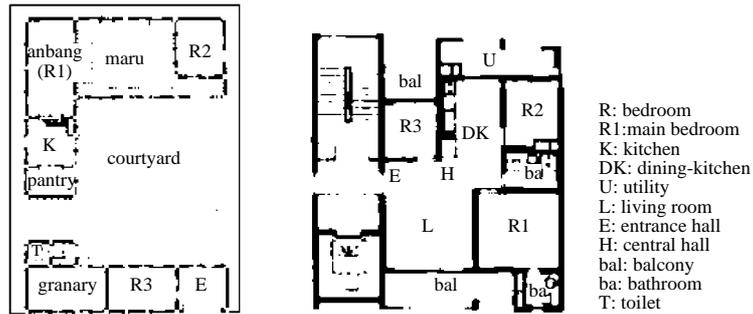
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## 1. Introduction

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 complex 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 (Figure 1).

**Figure 1. Urban traditional house and apartment house**  
 (source: Lee, 1971, Kang et al., 1999)



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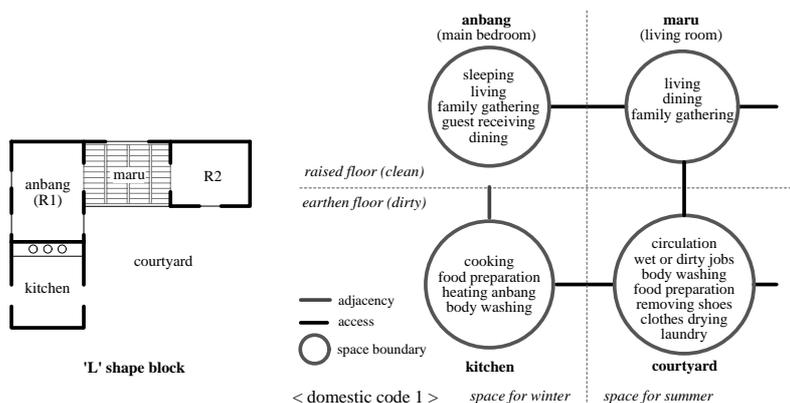
On the surface, morphologically, those two types are completely different. From Figure 1, one can see the central courtyard house, which is inward-looking, has now turned into the self-contained modern apartment house, which is outward-looking. What has been changed is not only the overall form. Some spaces like the courtyard 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 integration values. To deal with this subtle problem, this paper focuses 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 Seoul there are two representative types of apartment housing, a staircase access type and a balcony access type; other types are rare. Since the layout of unit plans tends to be seriously affected by access types from the initial stage of design, this research, for the consistency in analysis, will concentrate on one type – the staircase access type. Compared to the balcony access type which has an additional limit in planning the access balcony side, it has more flexibility in layout, thus is believed to reveal more for the understanding of the configurational logic. This research, then, further limits the scope by focusing on the three-bedroom plan which is statistically the most dominant in Seoul <sup>1</sup>.

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

The urban traditional house was developed in Seoul around 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 other neighbours. While the layout could vary from one site to another, it typically contains a unique structure that encloses the main functional rooms (Figure 2). For hundreds of years, this “L” shape block has been the distinguishing feature of the houses in Seoul (Joo, 1980) and 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 urban traditional house, this “L” shape block had to be placed along the site boundary around the central courtyard as in figure 1. 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 (Figure 2).

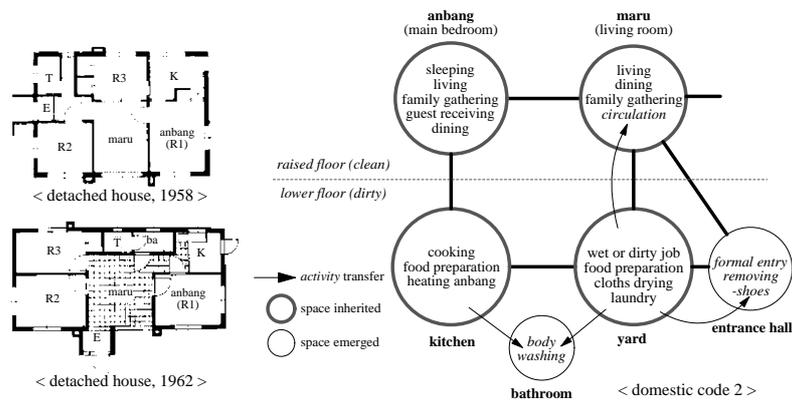


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**Figure 2. “L” shape block and the domestic code in the urban traditional house**

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 due to the fact that these rooms could not be associated with particular functions. In the diagram, some representative activities of each space are shown inside the circles. Rather loosely programmed, these spaces could accommodate various kinds of functions including the 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 seasons, 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, it formulated the conceptual distinction of “raised-clean-living zone” versus “earthen-dirty-subsidary zone”. This spatial code 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.

**Figure 3. Modern detached houses and the domestic code**  
(source: house plans from Kang et al., 1999)



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 the anbang now takes the stronger role as a main dining room 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.

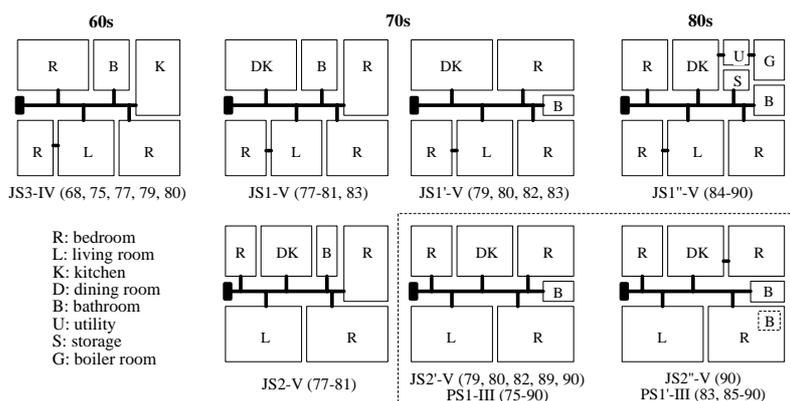
In this phase of evolution, the maru became the most integrated space taking the function of circulation from the courtyard. Although this central room should allow many through-movements, it could still accommodate many activities as shown in the diagram owing to the traditional floor-sitting style 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.

These modern detached houses were the first generation of modernised homes that suggested possible ways of modern configuration that can enclose the indigenous pattern of living; hence they strongly affected the following apartment house plans.

### 3. Evolution of apartment house plans: 1960s to 1990s

After its first mass development in Mapo 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 half the citizens<sup>2</sup>. 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 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” (1992). 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 were chosen for the purpose of this paper (Figure 4).

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**Figure 4. Typical 3 bedroom plans in metropolitan Seoul**  
 (source: reproduced from Kim and Park, 1992)

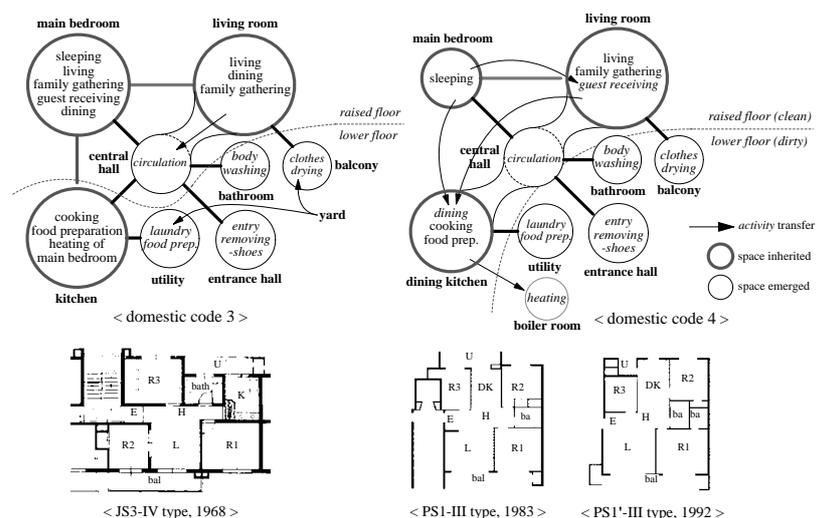
The labels under each plan are from the authors’ sorting method and here it is sufficient to know that the first letters “J” and “P” mean they are from the public sector (KNHC) and the private sector respectively, and the second letter “S” stands for a staircase type. Following the labels are the years 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 with the public sector (see the dotted-line box in the Figure). Since these two plans were more repeatedly used in both sectors, it is presumable that they make up the bigger portion than any other types in the apartment housing stock.

Gangnam-gu, the district that has the second largest apartment stock in Seoul, was chosen to examine what has been described above<sup>3</sup>. By taking all geometrically different 3 bedroom plans from each apartment complex, 75 plans could be collected

from the area. Amongst them, 21 cases were PS1-III and 22 were PS1'-III, occupying 28% and 29% of the sample respectively; thus, when combined, these two types alone make up overwhelming 57%. What could be also found was the clear division of the construction period by these two types: in the 80s, there were 16 PS1-III and 1 PS1'-III, but in the 90s, reversely, 2 PS1-III and 21 PS1'-III. From the result, it is safe to say that PS1-III and PS1'-III are the two most popular types representing the 80s and the 90s respectively and shaping the typical middle-class home life in Seoul.

All the plans in Figure 4 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 becomes a part of the fully inter-connected public realm (see code 4 in Figure 5). In this paper, for consistency of analysis, this type of circulation zone will be regarded as an independent convex space with a label of central hall.

When the seven plans in Figure 4 are adapted to the domestic code format, surprisingly, only two types of code emerge (Figure 5). Code 3 on the left applies only to the earliest plan (JS3-IV) and all the other following plans, in spite of their configurational variety, converge onto code 4 on the right.



**Figure 5. Domestic code 3 and 4 with related apartment plans**  
(source: house plans from Kang et al., 1999, website, www.r119.co.kr)

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 was poorly suited 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. Code 4 further reveals that the kitchen absorbs the dining function and becomes a crucial axis of the public domain. For the main bedroom, on the other hand, 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<sup>4</sup>. 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.

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. Topological paths in evolution**

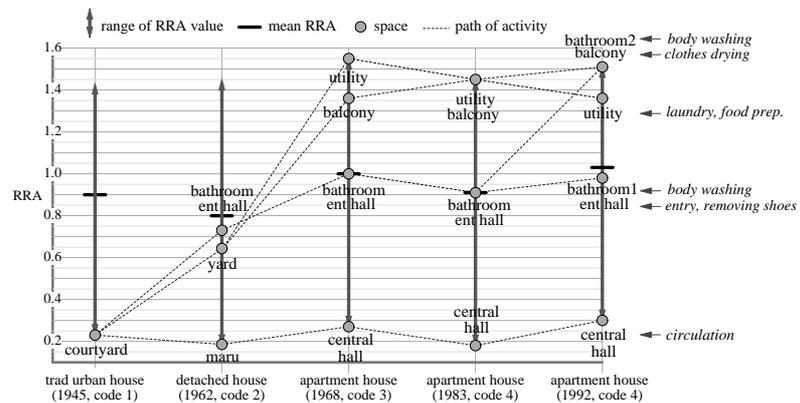
Over-viewing the whole process, some important points can be summarised. The traditional link of the four essential spaces was still preserved in the detached houses of the 50s and 60s, but when it comes to the apartment houses all the relationships are re-arranged, and the yard disappears leaving small 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.

Through the space-activity interactions, the most activity-depleted space is the main bedroom, which implies that it lost its traditional meaning as the most important space for the whole family. The change in the kitchen’s status is remarkable; it is the only space that has successfully crossed the conceptual boundary between the “dirty low-level zone” and the “clean high-level zone”. If the anbang and the maru were regarded as two axes of public activities in the past, then the living room and the dining-kitchen replace them in the modern apartment houses.

The most startling change above 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. 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. This process of “activity relocation” can be illustrated by means of RRA values (Figure 6).

80.8

Figure 6. Topological paths of the activities of the old courtyard



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 fringe in apartment houses, and this location is likely to have higher RRA values.

Interestingly, what has been transferred from the courtyard is not just activities it enclosed but its structural concept – “the lower level of the yard” itself. 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 to be separated from the clean living zone in the upper level – though the level difference has been reduced to a few centimetres. It is found from the four phases of the domestic code diagrams that the “raised versus lower” distinction keeps operating all the way through. 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 initial function is now totally lost but the secondary function, the clean-dirty distinction that was “acquired” through long practice, has been transferred to the modern homes.

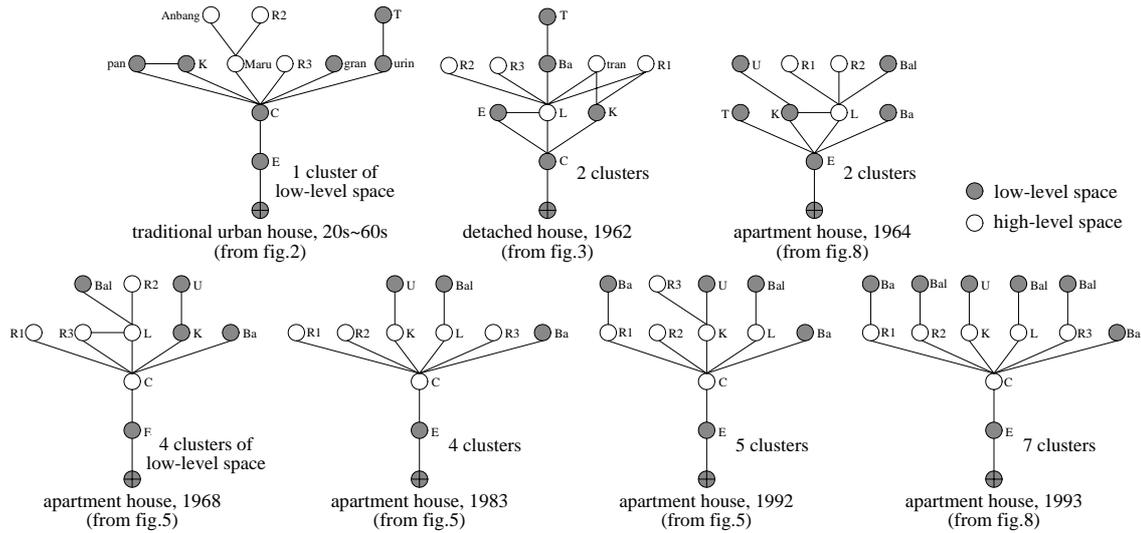


Figure 7. Justified graphs of the houses in Seoul from 1930s to 1990s

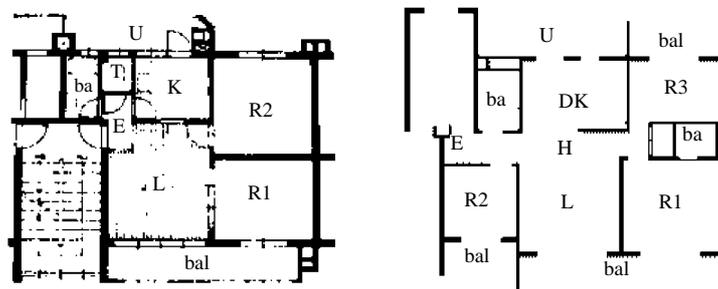
From the fact that the level distinction has survived the transformation process of the yard, a possibility arises that this line of thought can be expanded to the domestic space as a whole. If this conceptual dimension has acted as an underlying force to affect the evolution process, then, is it also possible to detect its paths that follow certain directions? This assumption can be investigated first by relying on the most fundamental method of space syntax, the justified graph (Figure 7).

In Figure 7, five house plans from the previous figures are converted into the justified graph format with the dark dots representing lower-level spaces and the white dots raised spaces. Two more graphs were added on the far right side of each row; they are from Figure 8 to represent the earliest staircase type unit (1964) and the 90s' new two-bathroom type<sup>5</sup>. In the first graph of the urban traditional house, the courtyard ("c" in the graph) is placed in the centre and binds all the low-level spaces together in one cluster, which means that one can move from one lower-level space to another without removing shoes. The next graph represents the detached house of 1962 with two clusters of dark dots. In this self-contained house, the bathroom and the toilet form an isolated cluster where extra pairs of slippers exclusively for this separate lower dirty zone are worn. The first staircase type plan of 1964 also maintains, with a different arrangement, the two clusters. Considering the configurational restrictions in apartment unit design, however, this earliest attempt to group the six low-level spaces in one cluster seems quite intentional, and therefore could be interpreted as a conscious effort to separate the two zones.

The two graphs for the 1968 and 1983 apartment houses have four clusters of dark dots. The difference between them lies in the kitchen's changing status to a high-level space in the later plan as has already been noted. As a result, after the 1968 graph, no more multi-space clusters appear and only the singular cells of sunken rooms are scattered across the houses. What should be pointed in the last three graphs, from the 1983 plan to the 1993 plan, is the on-going trend of cluster-increasing; this has resulted from the extra bathroom in the 1992 plan and the two more balconies in the 1993 plan. This exactly reflects the general trend of unit planning in Seoul which has been pointed out by many researchers; the two-bathroom plan, PS1'-III, becomes dominant in the 90s, and the number of balconies are constantly growing from the 70s on to cover the whole perimeter zone in the late 90s (Choi, 1996; Kang et al., 1999).

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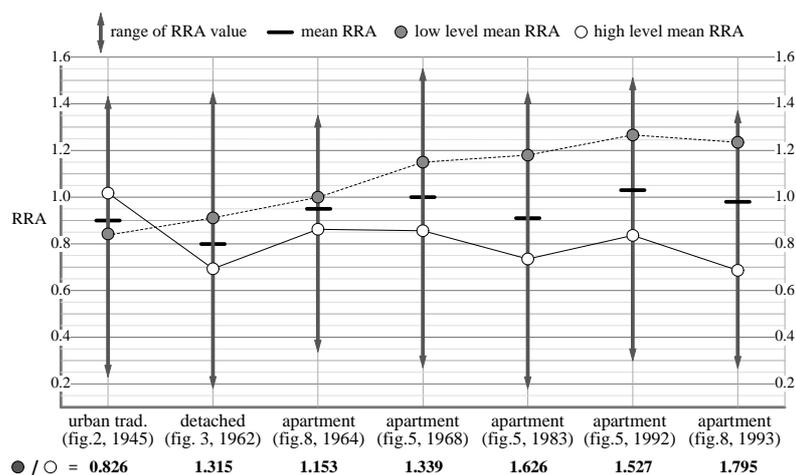
**Figure 8. Earliest staircase type plan (1964) and new two-bathroom plan (1993)** (source: Kang et al., 1999, website, www.r119.co.kr)



Looking at those seven graphs together, some transitional patterns can be easily recognised. The number of clusters is increasing while the number of spaces in each cluster is decreasing. In the urban traditional house, the low-level spaces are all connected from the shallowest part to the deepest part of the graph, but from the detached house, those spaces in the deepest part begin to be separated, making another cluster. The number of isolated clusters on the top edge of the trees is getting bigger through time, and finally all of the end spaces in the last graph are occupied by the low-level spaces. In a sense, it is as if all the dark dots have been gradually decentralised by a centrifugal force while the white dots have converged into the central area – the two contrasted spaces are moving towards two opposite directions. If the first and last house plans are directly compared again (see Figure 1), it can be realised that this is the necessary procedure for the traditional housing to arrive at the totally reversed form of the modern apartment configuration.

Now it is possible to convert these justified graphs to RRA values (Figure 9). In the graph, the dark dots represent the mean RRA of low-level spaces and the white dots that of high-level spaces. As expected from the justified graph, the mean RRA of low-level spaces in the urban traditional house is lower than that of high-level spaces. In the detached house, this order is reversed as the maru replaces the

courtyard by becoming the most integrating space in the house. Starting from the first apartment house in 1964, the two heterogeneous RRA values are gradually diverging from each other while the mean RRA values are maintained with small changes<sup>6</sup>. This bipolarisation exactly reflects what has been observed from the justified graphs. The high-level living spaces are centralised around the central hall, and more low-level subsidiary spaces are placed on the outer edge to surround the unit.



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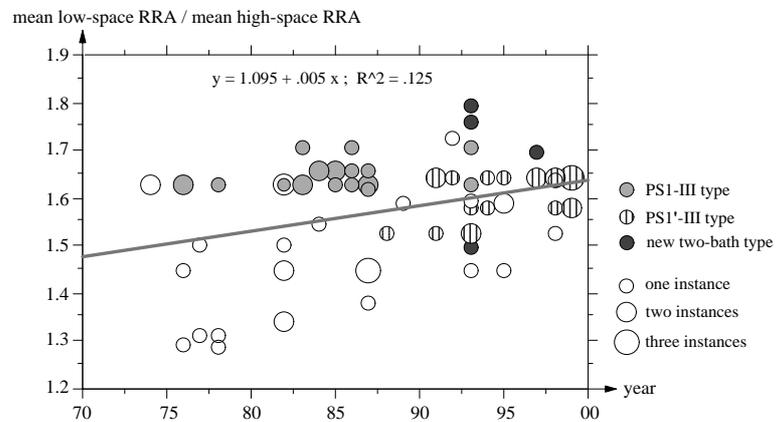
Figure 9. Transition of the mean RRA of lower and higher level spaces

The value right below each house label can show this trend more clearly. This value is gained by dividing the mean RRA of low-level rooms by that of high-level rooms. It is a useful way to further “relativise” the difference between the high and low spaces within a system for better comparisons with others. The increment in the value means that the low-level spaces are getting more segregated, or the high-level spaces more integrated, or both. When this relativised value is applied, the gradually increasing values are found for the apartment houses, which confirms the visual observation of the divergence in the graph; each category of space is moving to the opposite direction, thus getting more differentiated. The only exception is the 1992 house of which the value is lower than that of the previous 1983 house. It is found by inspection that this decrease in the value is due to the following reason. The second bathroom in the 1992 house inevitably blocks the direct access from the central hall to the bedroom in the north, thus causing the alternative access via the kitchen (see its plan in Figure 5). This has to happen for geometric reasons against the designer’s intention, hence the value again goes up when this problem is solved in the 1993 plan where the second bathroom is placed in the opposite corner.

Now, the same analysis is applied to the 75 sample houses in Gangnam-gu area of Seoul. The purpose of this is to examine whether or not the trend found from the small number of representative plans is also recognisable from the global scale

observation. The relativised value, which is obtained by dividing the mean RRA of low spaces by that of high spaces, is again utilised, and the 75 values from the entire plans are plotted on a scattergram (Figure 10). These sample houses were built between 1974 and 1999, so, chronologically, this graph corresponds to the later period after the 1968 house in the previous graph.

**Figure 10. Scattergram showing the chronological distribution of the relativised value**



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The two major types, PS1-III and PS1'-III, and the new two bathroom type – representing the last three phases in Figure 9 – are hatched so as to be distinguished from the other minor types. The pattern of these three generally matches the trend in figure 9: the average value of PS1-III is 1.65, PS1'-III 1.61, and the new two bathroom type 1.69. Whereas this pattern verifies the exceptional value-drop of the 1992 house in figure 9, it does not conform to the overall tendency of a gradual rise in the value. In other words, in the light of the major plans, it seems that these last three decades of the housing evolution do not strengthen the argument of this paper that the two heterogeneous spaces are topologically diverging from each other – though the technical reason for this has already been explained.

Now, the hatched dots are seen together with the blank dots, i.e., the minor type plans. From the perspective of the whole sample, two trends emerge. First, the three representative types, in most cases, have higher values than the minor types and their proportion in each period is growing – they thrive as time passes. Second, the minor type plans, in contrast, are decreasing in terms of their proportion of the total, and this happens, interestingly, more intensely for those in the lowest position in the graph – those with the lowest value are gradually becoming extinct. The existence of these two different trends is an important clue that suggests that the direction of evolution is closely related to what the relativised value implies. Syntactically speaking, the “fittest” in the market has been the plan where the high-level main functional rooms were more centrally linked while the low-level rooms were pushed out to the more segregated area. Therefore, those plans that fit this condition, thus having the higher relativised value, had more chances to survive, and those that did not had fewer chances.

The analysis of the 75 sample plans reveals that, in this last stage of the evolution, the two contrasted topological movement of the high and low spaces are still active, and, surprisingly, it is the minor types that reflect this trend to a stronger degree. More importantly, the scattergram suggests a possible explanation of how this pattern of evolution occurs. If the topological differentiation of the low and high-level spaces is the evident direction of the housing evolution process in Seoul, then it could be the “selection” in the market that facilitates it.

### **5. Genotypical property of space**

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 floor to restore the floor heating in AID apartment housing in 1974 (Zchang, 1994; Kang et al., 1999).

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The transformation process of the domestic code described in this paper is to show that it is not simply the changing arrangement of rooms but the interaction between the space and its activities within the domestic field that can precisely define the new space, and there is an indigenous concept of level-distinction that was actively involved in this process. Guided by these underlying forces, the evolution of the housing in Seoul has followed certain topological paths to adapt the old genotypical properties to the new physical environment, and the user’s reaction described above proves that these values do persist through the formal changes.

#### **Notes**

<sup>1</sup> The unit plan that has 85 m<sup>2</sup> net floor area is the highest in number in Seoul, and most of the plans close to this size are 3LDK. In the earlier samples, however, we can find 3LK plans under 60 m<sup>2</sup>. In this paper, we will use samples that have 3 bedrooms regardless of the size since we are more interested in the topological change rather than the geometric size.

<sup>2</sup> Between 1975 and 1979, apartment housing began to take the lead in the market by providing 47% of the new housing construction in Seoul, and the ratio kept growing to reach 90% in 1999. It provided 51.8% of the housing stock as of 2000 in Seoul (Korea National Statistical Office, 2001).

<sup>3</sup> This area, having been a suburban area before, began to be developed along with the boom of the 70s’ apartment construction and has been continuously developing new apartment communities. As a result, it can best represent the city of Seoul with a variety of plan types from the early period until the latest years.

<sup>4</sup> These room-activity relations could be controversial in that a type of plan can accommodate a wide spectrum of living styles. Therefore these codes suggest only the general pattern of change in spatial usage in Seoul. For the survey data of space usage in 3 bedroom apartment plans in Seoul, see “Kim and Yoon, 1992”.

<sup>5</sup> The 1964 plan is included notwithstanding that it has only two bedrooms because it can give us a clue to what the designers of this earliest plan had in mind – we cannot find 3 bedroom plans until 1968. The 90s’ new type can be defined by its three bays in the south and two bathrooms which are detached from each other within the unit.

<sup>6</sup> While the two heterogeneous spaces are getting more differentiated, the mean integration values of the apartment houses stay in a certain range; they are moving between 1.028 and 0.909. It is mainly due to the existence of the central hall that tightly binds up spaces together symmetrically from the middle without allowing the asymmetrically long sequence of rooms.

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