SYNTACTIC ANALYSIS ON SPATIAL STRUCTURE OF COLLECTIVE HOUSING UNITS

Comparative study on 2 public housing projects in Metro Manila, Philippines

Maria Carina DE GUZMAN*, Toshihiro HANAZATO** and Shinji TOMIE***

ABSTRACT

This paper discusses a syntactic analysis on the topology of domestic space in 2 collective housing projects in Metro Manila Philippines. Graphical methods were utilized to compare housing with different floor areas and for different income groups, with the conjecture that there will be similarities in the space development, notwithstanding the said differences. To analyse space patterns, justified access graphs were used, while relative asymmetry and control values were calculated. The results evinced the living area as the transition space between the public and private domains and the dining/kitchen area as the hub of the unit.

Keywords: collective housing, medium-rise housing; space syntax, spatial structure, user study, Philippine Domestic Architecture

1.0 INTRODUCTION

Domestic architecture in the major cities of the Philippines has attained new configurations as can be seen from the recently burgeoning collective housing structures. The government, in its attempt to contend the housing problem of the metropolis, started to build these, to be able to provide the most number of dwellings on the scarce land.1 The housing are made up of individual units which have independent facilities (kitchens, toilets and baths) and the rights to the units can be acquired. Statistics released by the U.S. Department of State2 reported that the population of Metropolitan Manila in 1997 was 10.4 million people and that its annual growth rate was 3.05%. The metropolis actually comprises only 0.2% of the whole land area of the country, but 13% of the 80 million total population is concentrated in this urban center. The specific housing need is for the lower to middle income family groups and it was reported that in 1998, this demand rose to 3.5 million units nationwide, with the bulk burdening the major urban areas.3 Settlement strategies have started with relocating squatters to developed areas as well as providing units for the homeless. Within the different cities of the metropolis, areas were chosen where collective housing communities could be developed. These forms of housing are relatively new to the Philippines such that there are many aspects that have to be studied in order to come up with designs that will fit the needs of Filipino families. It is therefore considered essential to study the design and use of those areas which are already occupied to be able to provide base data for the improvement of future housing projects.

2.0 OBJECTIVES

The general objective is to provide base studies for the future development of collective housing in the Philippines. Post occupancy studies were undertaken to study the development of spaces within the units and to find out a general design pattern. This specific research aims to compare through a syntactic analysis, the space development of dwelling units in 2 collective housing projects in Metro Manila. These projects are the MRB Housing Project in Barangay Commonwealth, Quezon City and the San Vicente Bliss Housing Project in Diliman, also in the same city.4

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The MRB project, built in 1996, is a recent housing venture of the government and its design is intended to be used in other housing locations. The Bliss housing, on the other hand, was completed in 1980 and is one of the initial undertakings of the government in the provision of collective housing in the city. It has a typical housing design which is replicated in three different housing projects in major areas around the metropolis.

The target users for these government projects come from two different social classes. Philippine social classes have been particularly divided into 5 groups, based on income level: upper class; upper-middle class; lower-middle class; upper-lower class; and lower-lower class. The MRB project was designed to fit the affordability of families belonging to the lower-lower income class, while the Bliss housing project targeted those from the upper-lower income class. The sizes of the units of the 2 projects are, therefore, not the same and that for the MRB project is a marginal 19.50 square meter in size; while the Bliss units have 54.00 square meter areas - more than double the MRB sizes. (Table 1)

The original condition of both housing projects is open-planned and only the service areas are provided. For the two projects, therefore, the users were the ones who organized and designed their units, putting up partitions and assigning the spaces for the specific areas. User preference and behavior is established through user surveys and ocular observations. This research aims to actuate the also imperative graphical and analytical evaluation, contending that it is consequential to have a syntactic analysis of the arrangement of spaces in these user-developed dwellings. It is expected that similarities will be seen in the two types of units, notwithstanding the difference in floor areas. The focus is on the access and adjacency of the interior spaces. The justified access graphs and calculations of the relative asymmetry (RA) value, as well as the control values of the spaces are utilized for the analysis.

3.0 METHODOLOGY AND LIMITATIONS

For the collection of data from the MRB project, permission was first requested from the local government group functioning as the administrative arm within the project area and they informed the homeowners through the head of the association. From all the members consenting to be interviewed, 2 or 3 units were randomly chosen from each of the 20 buildings. On the other hand, for lack of a unified association for the Bliss Housing Project, 1 or 2 units were chosen from each of the 23 buildings, depending on the availability and consent of requested household members.

The surveys were undertaken on 2 occasions, during December 1998 and December 1999. A group of students from the University of the Philippines conducted the user interviews for 4 consecutive week-ends, when most of the family members, especially the household heads, were available for interview. It was also not uncommon, that an appointment was set for a time convenient for the respondents. During the interview, the respondent was encouraged to make additional comments to obtain more specific insights. Permission was also solicited from the inhabitant for the unit to be drawn and photographed. All partitions and invariable forms that were built from the time that the family moved in (i.e. the loft for sleeping) as well as all the furniture and appliances and other increments were indicated in the drawings.

The syntactical approach examines the relations of specific spaces, and while Bliss units have defined rooms that can be designated into distinct spaces, MRB units are unpartitioned. Distinction and delineation of areas for these units is therefore based on the use of space and the furniture lay-out, which were gathered from ocular observations and responses to the questionnaire.

4.0 SUBJECTS' PROFILE

4.1 THE STRUCTURES AND THEIR USERS

The MRB housing project is located at a government-owned area which was entrenched with squatters during the last two decades. With the aggravation of the problem, the local government worked to relocate the existing households to residential buildings which were constructed within the same vicinity. The medium-rise buildings or MRBs are made up of 5 storeys which is the maximum allowed for structures to be constructed without elevators. The "MRB" designation was used by the developers to distinguish the area from another housing project having rowhouses, but was later adopted by the inhabitants and other users to identify the place. A chapel, a health center and an elementary school are provided in the area. (Figure 1a) There are a total of 22 buildings with units having 19.50 square meters each, while 2 other buildings have bigger units at 30.00 square meters each. For the study, 50 units of the former were surveyed. Each of the MRB buildings has 5 storeys and 9 units per floor. (Figure 2a) Examples of different unit layouts made by residents are shown in Figure 3a.

For the 50 households surveyed, sixty-four percent (64%) are occupied by nuclear families, with the average number of members being 4.6 persons. The average age of the father in the group is 36 years while the average age for the mother is 34 years. All the heads of the families have some form of education, with 45% reaching the college level and 20% getting their college degrees. 92% of the household heads and 44% of their spouses are employed. (Table 2a)

The Bliss project, on the other hand, is located near the university area and was originally intended for government
Figure 1a  SITE DEVELOPMENT MAP
MRB HOUSING PROJECT

Figure 1b  SITE DEVELOPMENT MAP
BLISS HOUSING PROJECT

Figure 2a  TYPICAL FLOOR PLAN
MRB HOUSING PROJECT

Figure 2b  TYPICAL FLOOR PLAN
BLISS HOUSING PROJECT

Figure 3a  SAMPLE UNIT PLANS
MRB HOUSING PROJECT

Figure 3b  SAMPLE UNIT PLANS
BLISS HOUSING PROJECT

Table 2a  HOUSEHOLD PROFILE

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<td>AVERAGE SIZE OF HOUSEHOLD</td>
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Table 2b  HOUSEHOLD PROFILE

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employees whose wages are relatively lower. It is made up of 23 buildings and provided with a shopping center which has been converted into a multipurpose hall. (Figure 1b) The typical floor plan is presented in Figure 2b, while two different examples of unit layouts made by the inhabitants are shown in Figure 3b.

For this surveyed group, the results show that the average number of occupants is 5.8 members. Nuclear families make up 68.5% of the households, while the rest are made up of extended families or had some students renting bedspaces in the units. The average age of the fathers is 51.5 years while that of the mother is 50 years. The heads of the families are all college graduates, 90% of them being gainfully employed and the other 10% made up of retirees. 72.5% of the wives also held jobs. (Table 2b)

4.2 DESCRIPTIONS OF SURVEYED PLANS

For the housing plans of the 50 surveyed units in the MRB housing project, the recurring pattern is for the living area to be located right after the entry and this space leads to the dining/kitchen area and the bedroom areas. With the average family size being 4.6 members, the bed areas are either bunk beds (2-tiered), while some spaces are converted to sleeping areas during the night. Only a small number of unit owners allot a small portion of the living room into a fixed bedspace. It is more common that lofts were added for additional bed area and storage.

For the surveyed units with the Bliss Housing project, what is similarly found is the position of the living room which is also directly accessible from the entry. For this group, the dining/kitchen area can be seen to be the main area that connects to the other rooms. Since the units are relatively bigger, specific bedrooms can be assigned. When more than 2 bedrooms are needed, a smaller room is provided and directly accessed from the living area.

In both the original configurations of the units, a toilet and bath area as well as a sink area were provided at the far end of the unit. Respondents have commented that the location is convenient, since these areas which are considered private and are used for personal activities are not visually accessible. This can be considered to be influenced by cultural and social factors. A study on the history of Filipino dwellings will show that these areas are often situated in inner portions of a house and far from the main entry.

4.3 ACTIVITIES WITHIN THE UNITS

For the general activities within the units of the 2 projects, similarities were observed. It was seen that the living area was used for family activities and it was the main area to receive guests. It usually contains those furnitures or appliances which the family would like to show they have. (i.e. tv, stereo components, vhs players etc.) Bedroom areas are relatively located in zones which are not easily accessible and for the MRB units, although there are no fixed partitions, visual accessibility is at least impeded by furnitures or curtains. The dining/kitchen space is used for other functions aside from the preparing and eating of meals. For the MRB units which have limited floor areas, flexibility is applied, such that this space is where the ironing of clothes is done or where the kids do their homework. There are more members who use the living room as a sleeping area. The toilet and bath area also extends its function by being used as the area for washing laundry while the drying is done outdoors.

In examining the ratio of the living area and the dining/kitchen area with regards to the whole unit, it can be examined that the MRB units allot a bigger portion of the whole space to their living area (average of 37.9%) and dining/kitchen area (34.0 %) compared to that of the Bliss project which has an average of 18.6% and 16.7% respectively (Graphs 4a and 4b). This can be associated with the use of space, since the MRB residents maximise these spaces for ancillary functions.

In observing the relation to the immediate outdoor, it was noticed that for both the housing projects the front windows of the units were left open during most part of the day, not only to allow for through ventilation but also for easy visual access to the corridor area. This corridor area is often used as a play area for children and for group activities like parties for building occupants or meetings within the group. It was also observed that some adults use it as a rest area where they either do individual activities like reading a book or where they join in with their neighbors for some idle chat. The corridor thus serves as a venue for casual contact with neighbours.

5.0 SYNTACTIC ANALYSIS

5.1 SIGNIFICANCE

In rationalizing the use of the syntactic approach, it is explained that analyzing the interior spaces quantitatively through this method, allows for a determinate value pronouncing connecting features between spaces, thus clarifying the correlations. The Social Logic of Space, which introduced this system explains that "this method of representation had an immediate advantage over the plan; it made the syntax of the plan (its system of spatial relations) very clear ..." and also that it aims "to compare the relative position of the differently labelled spaces in a sample of plans, thus identifying the syntactic relations characteristic of different labels. More important, it led to the realised that analysis could be deepened by learning to measure these properties."7

5.2 JUSTIFIED ACCESS GRAPHS

In the analysis of the unit interiors, justified access graphs were, therefore, used. These are "representational devices" which synthesize patterns used to describe the symmetric and asymmetric as well as distributed and non distributed properties of spaces. It was stressed that being graphs in themselves, these justified access graphs facilitate the easy measurement of syntactic properties such that they allow a "form of analysis that combines the visual decipherment of pattern with procedures for quantification".
The justified access graph starts with a "carrier" represented by a circle with a cross, and stands for that space in the exterior of the unit. The interior spaces are represented by circles and their connections to the carrier are indicated by straight lines. The spaces which can be directly accessed or penetrated from the carrier are positioned on the same horizontal level, notwithstanding the difference of their distances from the carrier. From this first level, the other areas which can be accessed from the initial spaces are then drawn, showing connections and accessibilities.

In the application of these graphs to the units of the 2 projects, it was the spaces or rooms which were studied for their position and relation to each other. For the MRB project, the spaces were delineated by function and furniture lay-out and there were 5 justified access graphs which were developed. (Figure 5a) With the small area of the units and the fixed positions of the toilet and bath and sink area, it was noteworthy that there were still different justified access graphs that were developed. This reflected that even with the limitations in the unit design, there were variations on the way that the users positioned their openings to connect one space to the other or on the way that the furniture was positioned to create passages within the spaces.

78% of the units were charted into Graph A; 14% into Graph B; and 4% for Graph C; while Graphs D and E were developed from single units (2% incidence). The graphs explicitly showed the direct access of the living area to the exterior of the unit, and how it links to the other spaces of the dwelling. The next level connected it to the dining/kitchen area which served as the link to the other spaces. The limitation on the floor area of the unit resulted in some bedrooms also having direct access from the entrance (Graph C). Some units, mostly those located on the first floor, had commercial spaces (i.e. food shops or video rental shops) which were necessarily located at the front of the unit. (Graph D and E) These were positioned either before or contiguous to the living area.

In analyzing the interior of structures based on the justified access graphs, it is proffered that the distinction between distributed and nondistributed relations became simply the distinction between spatial relations with more than one, or only one locus of control with respect to some other space; while the distinction between symmetry and asymmetry became the distinction between spaces that had direct access to other spaces without having to pass through one or more intermediary spaces and whose relations were only indirect.

For the developed graphs of the surveyed MRB units, it can be seen that the arrangement of the spaces reflects asymmetry, since the graphs show that the living area had to be accessed first before reaching the other rooms. The nondistributed property can also be seen based on the first justified access graph which had 78% incidence, since this graph shows that there is only one major point of control and this is the dining/kitchen area. This space was directly connected to the living, bedroom and kitchen areas.

For the housing units surveyed from the Bliss project, there were 4 justified access graphs that were derived. Graph A is based from 50% incidence; while Graph B reflected 37%; Graph C - 10% and Graph D - 3%. (Fig. 5b) All graphs show the living room being directly accessible from the exterior, a feature similar to the other group surveyed. The dining/kitchen area shows a more important distributive position as seen in the tree patterns developed, with it serving as the connecting point to the other rooms. The bedrooms are located further into the unit, at the third level of the justified graphs denoting the preference for locating these in private areas.

For these units which had defined spaces, all the graphs demonstrate the asymmetric property with relation to the carrier, since the living room had to be accessed first before any of the other parts can be reached. For the interior of the unit, the relation of the rest of the rooms to the dining/kitchen area is symmetric, as seen in the evenness in the accessibility to the rooms. This is mainly illustrated in Graph Bls-A which has 50% incidence from the surveyed units. For the Bliss A and B graphs (50% and 37% incidence respectively) the nondistributed property can be seen since the dining/kitchen serves as the locus of control to the unit, being the point of branching out in the tree patterns.

5.3 Relative Asymmetry (RA)

Mathematical calculations are also used to corroborate the visual representations made from the graphs. The aim of the numerical side of syntactic analysis is to deepen descriptions by expressing in a concise way very complex relational properties of spaces and of the system as a whole. In particular, it is about considering individual spaces in terms of the whole system.

The relative asymmetry (RA) emphasizes the notion of depth and denotes how a space is related to the rest of the unit. Hänsön underscored that "for it was by redrawing the permeability graphs of a simple house from different points within the interior, that we were able to see that the configuration did not just seem different from different rooms, but that it actually was different. As the house was redrawn from different rooms, the pattern of depth in the graph changed. Some rooms seemed to draw the entire configuration towards the root: other rooms seemed to push most of the house deep.\textsuperscript{10} In effect, a low RA value, indicates how integrated a certain space is to the whole, while a high value indicates the opposite.

The relative asymmetry values for the spaces in Graphs A and B for both projects were calculated. This was done by "working out the mean depth of the system from the space by assigning a depth value to each space according to how many spaces it is away from the original space, summing these values and dividing by the number of spaces in the system less one (the original space). Then calculate relative asymmetry as follows:

$$\text{relative asymmetry (RA) } = \frac{2 (MD - 1)}{k-2}$$

\[ \text{where} \quad MD \text{ is the mean depth of the system and } k \text{ is the number of spaces in the system.} \]
Figure 4a  AREA GIVEN TO LA and DK SPACES  
MRB HOUSING PROJECT

Figure 4b  AREA GIVEN TO LA and DK SPACES  
BLISS HOUSING PROJECT

Figure 5a  JUSTIFIED ACCESS GRAPHS  
MRB HOUSING PROJECT

Figure 5b  JUSTIFIED ACCESS GRAPHS  
BLISS HOUSING PROJECT

Table 3a  COMPUTATIONS ON CONTROL VALUES  
MRB HOUSING PROJECT

Table 3b  COMPUTATIONS ON CONTROL VALUES  
BLISS HOUSING PROJECT
where MD is the mean depth and k the number of spaces in the system. This will give a value between 0 and 1, with low values indicating a space from which the system is shallow, that is a space which tends to integrate the system, and high values a space which tends to be segregated from the system. Relative asymmetry (or relative depth) can therefore be thought of more simply as the measure of integration.  

The relative asymmetry values for the spaces of 2 justified access graphs (78% and 14% incidence) of the MRB project were calculated and the matrices are shown in Figure 6a. The mean depths and the corresponding RA values are indicated. In comparing all the spaces, A2 which denotes the dining/kitchen area has the smallest RA value at 0.167, followed by A1 or living area at 0.333; bedroom and toilet and bath area both have 0.667; while the carrier has 0.833. The RA values of these last 3 areas are more than double the values of the other two, reflecting that these areas are syntactically segregated from the other spaces in the unit.

Similarly, the calculations for the Bliss project, show low RA values for the dining/kitchen area (0.68) as well as for the living area (0.268). The bedrooms, as well as the toilet and bath and utility rooms (0.40), all have higher values which are more than double those of the two other spaces. (Figure 6b) This similarly indicates the high integration of the dining/kitchen and living areas in contrast to the segregation of the other spaces to the rest of the areas in the unit.

5.4 Measure of Control value

The measure of control is another mathematical tool that is used for the syntactic analysis. This is utilised to account for the association of one space in relation to the other spaces directly adjacent to it. For a specific area, all immediate neighbors are given 1/n unit, (where n is the number of adjacent neighbors) and the sum of these for each receiving space is the control value of that space. It is explained that "in effect, each space is partitioning one unit of value among its neighbours and getting back a certain amount from its neighbours. Spaces which have a control value greater than 1 will be strong control, those below 1 will be weak control spaces."  

Table 3a and 3b show the control values for the different spaces in the main justified access graphs of the two projects. For the MRB project, Graph MRB-A which is seen in 78% of the units surveyed is used. The table shows a high control value for the dining/kitchen area (3.00) which is directly adjacent to the living area, the toilet and bath and the bedroom space of the units. The living area received a control value of 1.0 while the bedroom and the service areas only received 0.50 values, being accessible only from the dining/kitchen area.

In the calculations for the Bliss project, on the other hand, Graph Bls-A is used (50% incidence), and a very high control value is given to the dining/kitchen area (5.0) since it directly connects to the living room, bedrooms and other service areas. This is also illustrated in the justified access graph which shows this space as the point of distribution to other parts of the unit. The living area also received a strong value (1.20), being a direct neighbor to the carrier, the dining/kitchen area or a bedroom. The rest of the areas (bedrooms, toilet and bath, utility area) were positioned in the inner part of the unit, and could only be accessed from one of the main areas, such that their control values are relatively smaller (0.20).

6.0 CONCLUSIONS AND RECOMMENDATIONS

The syntactic analysis of spaces of the collective housing units have the following results:

a. The justified access graphs show that the living area is the main link from the exterior to the inner areas of the unit, serving as the transition space from the public zone to the private zone of the dwelling unit while within the unit, it is the dining/kitchen area which serves as the major tributary to the different spaces.

b. The calculation of the relative asymmetry (RA) established that for both housing projects, the dining/kitchen area (DK), having relatively low RA value is the most integrated space in the dwelling, while the living area also showed integration to the rest of the unit. The other spaces like the bedrooms and the toilet and bath areas have high RA values and are segregated from the other spaces in the system.

c. The calculation of the measure of control, also established similarities with both the MRB and Bliss housing projects. The results supported the other syntactic analyses showing that the dining/kitchen area and likewise the living area, having high control values serve as the main links to the other zones of the unit.

The syntactic analysis performed, thus shows the relationship of the spaces within the interiors of the units of the 2 collective housing projects which were planned and designed by the users themselves. In future designs for collective housing the relationships of the spaces within the units as well as the relationship to the exterior should be taken into consideration.

For housing research, it is contended that "the evaluations of individual domestic buildings, which are specific and unique artifacts, must be coupled with comparative research to identify elements of constancy and change amongst different residential settings and/or different user groups through the passage of time." It is therefore recommended that the results of this study be compared to the syntactic analyses of other forms of Philippine dwellings like single-detached units or duplex units, or to traditional Filipino homes used in earlier periods. It is advocated that in comparing different Filipino house types and also looking into the domestic architecture of different periods, a constructive cognition of Filipino housing can be attained, incorporating determinate notations, thereby defensible to function as guidelines for future housing endeavours.
このような方式が一般的である。したがって、調査対象2例の場合
も、入居者が各ユニット内の空間構成を決定、デザインしたもので
ある。

研究の方法は、各々の住戸ユニット内での住まい方を調査したう
えで、空間構成をスペース・シンタックス（Space Syntax）手法を用
いて空間構成を解釈し、同様を比較して相違点、相違点を示す。

MRB住戸については、調査した30戸の住戸ユニットのうちあたり
の平均居住者数は4.62人であり、空間構成は居間を玄関に直接隣接
として配置し、食堂・台所、寝室への導入空間として位置付けるとい
う一定のパターンが見出された。また、良い住戸面積のため寝室で
は2段階ベッドを使用する場合が多く、居間を寝室として兼用する
ケースも見られた。寝室空間および収納スペースを確保するため
に、屋根裏・ロフトを設けることも一般化していることが分かった。

サン・ヴィセンテ・プリス住宅で調査した30ユニークを利用して
は、平均居住者数は5.85人であった。空間構成では居間が玄関に直
結する傾向を示し、その点でMRB住戸の事例と類似している。ここ
でも食堂・台所がその他の部屋への移動の中心的経由空間としての
役割を有していることが確認された。この住戸は、各住戸ユニット
が比較的広い床面積を有していることから、寝室空間が食堂・台所
に隣接する形式で十分確保されていた。また2室以上の寝室を有する
ケースでは、1部屋が居間に隣接する形で設けていた。

以上のような調査から、フィリピンの公共集合住宅の住戸ユニッ
ト内の空間構成について以下のようにまとめることができる。

1）ジャスティフィエド・グラフ（Justified Access Graph）では、
2例の住宅ともに当然ながら共通して、居間が住戸ユニット内と
住戸外空間を結び付ける空間的役割を担っていることが示され
た。さらに、住戸ユニット内の始どの部屋が食堂・台所と隣接する
形で配置されており、食堂・台所が住戸ユニット内で空間的な中心
的機能を果たしていることが確認された。

2）居間および食堂・台所の奥行（Relative Asymmetry）算定値は低
く、両空間が居住者の日常生活において最も頻繁に使用されている
ことを示している。このことから、ジャスティフィエド・グラフが視
覚的、図式的に示した住戸内の空間の相互の関連状況を裏付けるも
のであり、両空間が各住戸内で営まれる生活において極めて高い統
制機能を有することを実証している。同様のことは、空間統制値
（ControlValue）の算定数値によっても確認することができた。

結果として、フィリピンの公共集合住宅では、住戸の規模の大小
に関わらず、居住者の使い方を反映した空間の構成・配置において
一定の構成をなしていることを明らかにした。ただし、詳細にみる
と床面積規模が各室の住まい方に影響を与えており、サン・ヴィセ
ンテ・プリス住宅では各室とも特有の機能、目的に応じて使い分け
られているのに対して、MRB住宅では限られた床面積の影響から各
室が複数の機能を担っている、たとえば居間は寝室、子供の学習空
間、さらには食堂を兼ねているケースがある等の状況を示した。

（2000年7月4日原稿受理、2001年2月20日採用決定）